ELECTRICAL REVIEW

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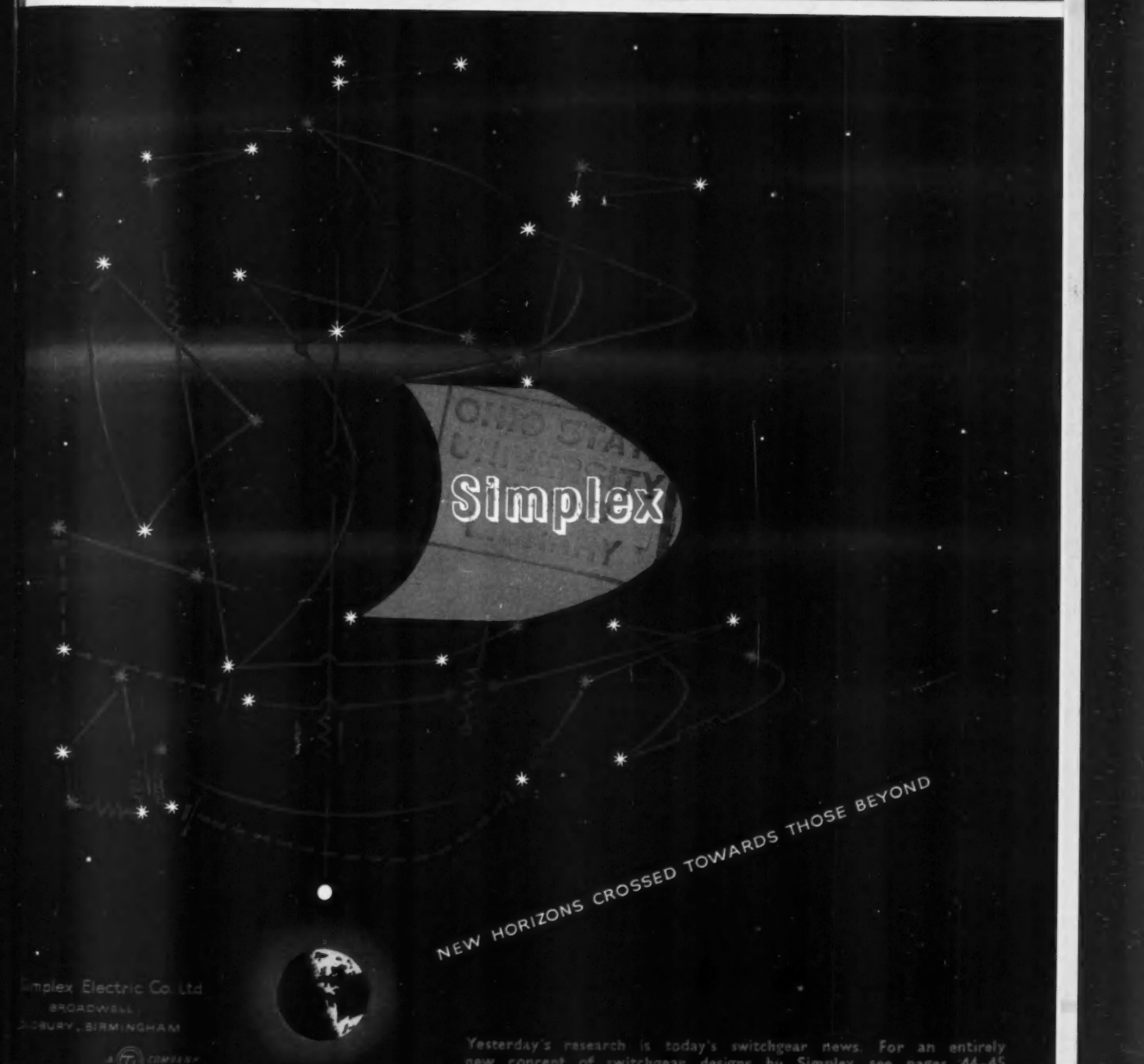

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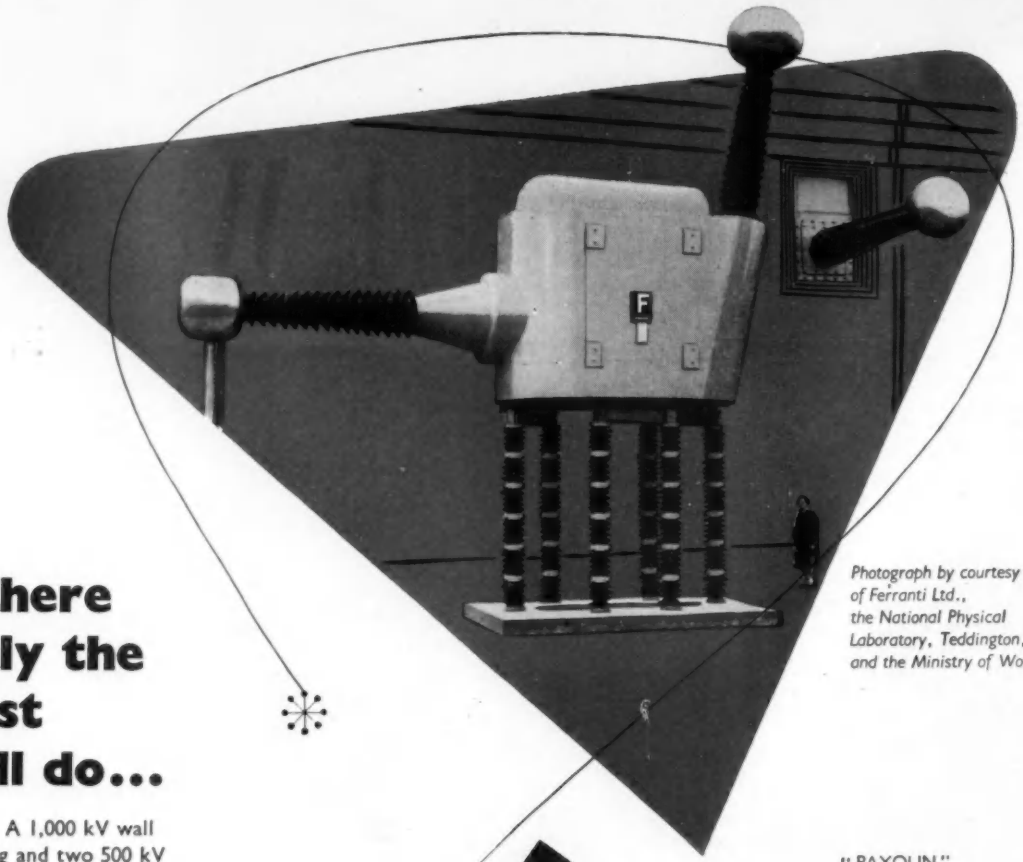

Photograph by courtesy of Ferranti Ltd., the National Physical Laboratory, Teddington, and the Ministry of Works.

Where only the best will do...

(ABOVE) A 1,000 kV wall bushing and two 500 kV transformer bushings manufactured by M. & I. and installed in testing equipment at the National Physical Laboratory, Teddington, under the direction of the Ministry of Works.

(RIGHT) Amino glass "PAXOLIN" used in remote control gear assembly.

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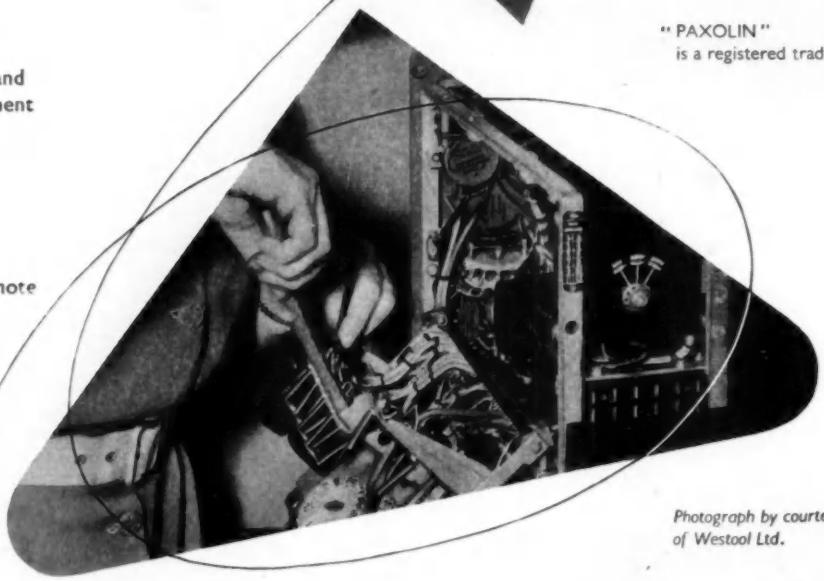

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ELECTRICAL REVIEW

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The Grid in Evolution

SINCE the first section was inaugurated (in Scotland) in 1930, the British grid system has been subject to considerable modification both as to national policy and to engineering developments. Its initial function of interconnecting the busbars of existing independently owned and operated power stations in order to pool reserve plant and concentrate production on the more efficient generating units was of limited application. With the shifting of industry and population under war conditions, the 132 kV grid, formerly sectionalised in areas which could be linked in emergency through tie lines, became more nearly a nation-wide transmission system, the scope of which is being enormously enlarged through the construction of the 275 kV supergrid and the possibility of later conversions of parts of it to 380 kV working.

A major factor in the advance made since vesting day is the freedom to select power station sites where water, fuel and transport conditions favour cheaper generation in place of a general restriction to local government areas to serve concentrated electrical demands, which can often be more adequately met by more numerous step-down transformer stations. In consequence generating units of very much greater capacity can make fuller use of the limited number of suitable sites available at a capital expenditure per kW that more than offsets the considerable increase in the cost of materials, while the higher steam conditions inherently associated with output capacity make for improved thermal efficiency.

Confidence in the even better reliability of large modern sets is illustrated by the adoption of the one boiler-one turbine combination in contrast to the pre-war practice of installing several more boilers than turbines in each power station. An important aspect today is that the flexibility imparted to the system facilitates the injection of power from nuclear stations. The savings to be secured progressively by these means were indicated by Mr. J. T. Moore at the World Power Conference (Canadian Sectional Meeting) and some particulars from his paper are given in this issue (page 589).

A fortunate feature of electricity generation is that designs to promote fuel economy have, broadly speaking, resulted in overall economy. It cannot

be assumed, however, that the highest practicable economy will be obtained automatically. A point emphasised by the author is the influence of a policy of exploiting any step in design to the maximum rather than making frequent smaller steps on which the anticipated economic return might not be fully achieved. High thermal efficiency by itself, as he pointed out, is not necessarily a criterion of high commercial efficiency. The aim is to secure the lowest obtainable cost per kWh generated, over the whole country.

AMERICAN PLANT CONTRACTS

Persistent pressure by the American makers of heavy electrical plant upon their Government to take action to prevent the award of contracts for such plant to overseas firms has forced the Government to order the Office of Civil and Defense Mobilisation to conduct an inquiry into the matter so far as it affects large steam generating sets.

The manufacturers' argument is that the placing of these contracts abroad endangers national security because of the difficulty of quickly obtaining replacement parts. Their immediate concern is the order awarded to C. A. Parsons & Co. by the Tennessee Valley Authority for a large steam set. The T.V.A. has refused to rescind the order, saying that Parsons have adequate repair facilities in Canada.

In some other cases the American manufacturers have contended that the diversion of work to foreign concerns would have a serious effect upon employment in the United States. To this it has been replied that the contracts in question represent an extremely small proportion of the American production of this class of equipment. As we have said before, the anxiety of the American producers is quite understandable but their action is not calculated to foster Anglo-American trade which the U.S. Government has endeavoured to encourage.

RESTRICTIVE TRADE PRACTICES

There was some difference of views at last week's annual dinner of the Electrical Wholesalers' Federation. Mr. Peter Thorneycroft, who was principal sponsor of the Restrictive Trade Practices Act, naturally viewed it paternally and considered it a promising child. He thought that it would weed out the inefficient and strengthen our competitive ability.

On the other hand the president of the E.W.F., Mr. Harry Riley, expressed the hope that the measure would be repealed within the next ten years. It was wasteful of time and effort and was causing a great deal of trouble to industry at large. He thought that much more would be accomplished by the operation of normal competitive conditions. We prefer Mr. Riley's view of the Act which was conceived at a time when conditions were much easier for industry generally. We fear, however, that political considerations rule out repeal, whichever party may be in power.

ANALOGIES

A physical insight into many problems connected with electrical engineering can be obtained by the use of analogies. This is clear from the article by Dr. J. R. Barker on the opposite page which covers both the theory and its practical application in the form of models. Among the examples of the models used, the author includes a description of analogue devices. There seems to be a certain amount of confusion between the terms "analogy" and "analogue," and we feel that we should try to give an explanation of our interpretations. Although we have been unable to find any definite distinction between the two words in any modern dictionary, we feel that each word has an individual identity.

The word "analogy" is essentially applicable to the idea of similarity in the abstract, whereas the word "analogue" is more applicable to the apparatus or the object of the analogy. Thus, in mathematics, "analogy" is used to mean proportion and in logic it is used to mean resemblance of relations, whereas "analogue" refers to an object having similar attributes. Dr. Barker deals with the analogies between electrical and mechanical phenomena and describes some of the analogue devices which utilise the similarities between these phenomena to solve electrical problems.

EXHIBITION REFLECTIONS

The number of exhibitions for which we receive details is steadily increasing despite the, also steadily increasing, feeling that there are already too many exhibitions and, moreover, that the new ones contribute little, and in some cases detract from those already established. It is significant that this fact was mentioned by Mr. Leslie Gamage on the opening day of this year's Electrical Engineers' Exhibition.

This increase is undoubtedly providing many problems, particularly the maintenance of stand quality and originality. Although exhibitions do undoubtedly play an important part in the advertising and sale of the industry's products, the primary purpose of our industry, or any other, is the production and operation of equipment making full use of the latest technological advances, and many firms, particularly the smaller ones, must find the effort involved in participating in a series of exhibitions somewhat burdensome.

The Electrical Engineers' Exhibition has become the electrical industry's premier display and few criticisms can be made. It is unfortunate, however, that while equipment manufacturers are very well represented, comparatively little impression is gained of the large sections of the industry devoted to installation, operation and maintenance. Without a doubt their activities are difficult to portray but the essential part played by them should not be overlooked.

SPIN AND TUMBLER DRYERS

During the past year the spin dryer has increased rapidly in popularity and sales are now reported to exceed those of washing machines. Next week's issue of the *Electrical Review* will contain an illustrated review of the various types of spin and tumbler dryers, including a number of new models. Details to be given will include size, clothes capacity, loading, speed, finish and price

ANALOGIES AND MODELS

Their Use in Solving Electrical Problems

By J. R. BARKER, Ph.D., A.Inst.P.*

Since experiments and tests on full-scale apparatus are, in many cases, inconvenient, engineers are making increasing use of models, analogues, simulators and computers, for it is only by practical experiments that the necessary physical insight into many problems can be obtained. This review is mainly confined to electrical devices used for solving electrical problems

ENGINEERS are making ever-increasing use of models, analogues, simulators, and analogue (and digital) computers for solving problems of system behaviour and design. In this article the reasons for this trend will be explained, but the account will be mainly restricted to electrical devices used for solving electrical problems. It seems best to begin with two specific examples, both of them models, to provide a background for some general statements.

Models

A model is a scaled version of the real thing so that the physical variables involved are the same in kind but differ in magnitude. Thus it is a common technique to study and design aerial systems[1] using scaled-down versions of the array inside the laboratory. The velocity of electromagnetic radiation is unchanged by modelling and the wavelength must be decreased by the same factor as the linear dimensions, therefore, since velocity = (frequency × wavelength), the frequency must be increased by the same factor. Consequently, an aerial system scaled down to 1/100th of the original size must be operated at (100 × the original frequency). The model will not be quite perfect, however, unless the penetration depth of the waves into the conductors and the losses in the dielectrics are also correctly scaled, which involves finding materials of the appropriate conductivity, permeability and permittivity at the frequency being used. Fortunately, the conductivity of metals is so high and the amounts of diclectric used so small in normal high efficiency systems, that neglect of these effects will not greatly impair the quality of the model.

The economic value of working on model aerials is obvious, full-scale ones being too expensive for the frequent modifications which might be needed during experimental work. A mathematical approach to the problem would probably be less profitable than making a model and would not make use of the engineer's practical experience and physical insight to the same extent.

Network Analyser

Next to be considered is modelling a power-distribution network on an a.c. network analyser.[2] Opportunities for testing and experimenting on a significant portion of the national power grid are rare indeed and experiments must generally be confined to models. So successful is this technique that significant economies in the running of the system have been discovered from such models. The

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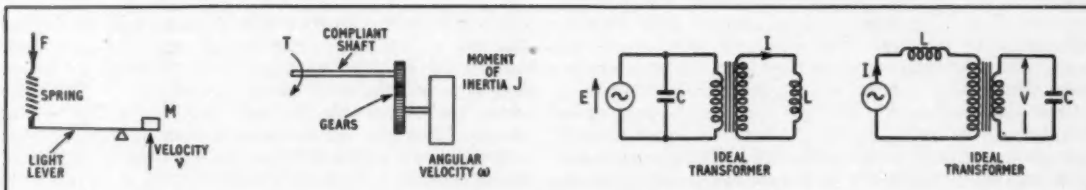


Fig. 1.—Mechanical and electrical analogies

Mechanical	
Mass M	Moment of Inertia J
Force F = M(dv/dt)	Torque T = J(dω/dt)
Velocity v	Angular velocity ω
Linear displacement ∫vdt	Angular displacement ∫ωdt
Resistive force proportional to velocity	
Compliance of spring = (displacement/force)	Compliance = (angular twist/applied torque)
Power Fv	Power Tω

Electrical	
Inductance L	Capacitance C
Voltage V = L(dI/dt)	Current I = C(dV/dt)
Current I	Voltage V
Charge Q = ∫Idt	∫Vdt
Resistance R	Conductance 1/R
Capacitance C = (charge/voltage)	Inductance L = (voltage integral/current)
Power VI	Power IV

alternative is to use a digital computer (slide-rules being inadequate) and indeed such work is being done. However, it is probably safe to say that an extensive programme of preliminary work on a network analyser would be profitable even when a digital computer is available, for it is only by practical experiments that the necessary physical insight into the problems can be obtained.

An a.c. network analyser consists essentially of three parts:—

(a) a collection of good-quality variable, accurately calibrated resistors, inductors, capacitors and transformers which can be interconnected into networks;
(b) generators to excite the network sinusoidally at various frequencies, or with pulses;
(c) voltage, current and power measuring equipment which can be applied to any part of the network.

Both the model network and the power system obey the same laws but the magnitudes of the physical quantities are different and appropriate scaling factors must be chosen. Suppose that, in the system, voltages are of the order of kV, and currents in hundreds of amperes, impedances are thus of the order of 10 ohms. In the model, voltages are conveniently kept to a few volts and impedances are conveniently centred on 100 ohms so that model currents will be in tens of milliamperes. Power $P = VI = 100$ kVA in the system and 1×10^{-2} VA in the model. Phase angles should be kept unchanged so that the distribution of power is modelled correctly, hence ratios such as $2\pi fL/R$ and $1/(2\pi fCR)$ must be unaltered. Frequency, f, may be scaled up or down if desired. Only three of the scale factors can be chosen arbitrarily.

In all models there are imperfections and some of those

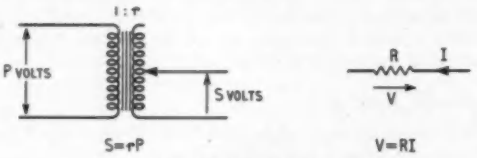


Fig. 2.—Ideal transformer and resistor

occurring in a network analyser arise as follows. Some impedances are likely to be too small or too large to be represented accurately within the available range, no matter how the problem is scaled. It then becomes a matter of engineering judgment to decide which components should be neglected or lumped with others. Care must be taken to ensure that the wiring used to interconnect the components does not introduce appreciable extra impedances, as thin wire might do if used with a central plugboard which involves long runs. Current is found by measuring the voltage across a small known resistance put in the lead concerned. These resistances must be small enough not to disturb the network but as this makes the available voltage small and difficult to measure accurately, some compromise is necessary. The frequency range of the system will be restricted by unwanted stray capacities and inductances whose presence is inevitable because of the physical size of the system. (A wide frequency range is particularly necessary if the system is to be used for the study of transient responses.)

Although such analysers have been made and used mainly by those concerned with the electrical power industry, their use need not be so restricted. Frequency, phase and transient responses of networks used in radio and television work can be obtained, although this work may be somewhat limited by the difficulty of making high-Q inductors at the low frequencies used in most present-day network analysers. The obvious step is to raise the basic frequency if an analyser is to be designed for such work.

At this point the engineering importance of modelling is evident. The engineer is dealing with measurements on a physical system, which is easier for him than solving the underlying mathematical equations. All his training and techniques and his acquired physical insight enable him to obtain useful results and conclusions with the least labour from physical apparatus. It is not, of course, intended to belittle the help which a skilled mathematician can give his engineering colleagues, but there are occasions when changing a few potentiometer settings and taking a few more readings is the equivalent of many hours of computation.

Analogues

A further application of the network analyser is in representing mechanical systems made up from masses, springs, levers, etc., or from moments of inertia, twisted shafts, gear wheels, etc., and also for representing combined electrical and mechanical systems such as gramophone pick-ups. It has long been realised that there is an analogy between mechanical and electrical systems and this was put to good use as long ago as 1926 when Maxfield and Harrison (Bell Telephone Laboratories) redesigned the mechanical gramophone soundbox using the then new electric filter design techniques, with good results.

In an analogue device, the same equations are obeyed as in the system being represented. This is also true in a model, but in an analogy the symbols have physical meanings different from those in the other system. Thus, seeking an analogy between electrical and mechanical quantities, the equation

$$V = L(dI/dt)$$

relates the voltage V and current I in an inductance, L, and the equation

$$F = M(dv/dt)$$

applies to a mass M having a velocity v due to an applied force F and both have a similar form although the physical quantities are quite different. Similar correspondence occurs in the case of a capacitance and an elastic spring, and it is not difficult to build up the complete analogy which is shown in the first and third columns of Fig. 1. Alternatively, the equation

$$I = C(dV/dt)$$

relates the current I and voltage V in a capacitor C, and this, too, has the same form as the preceding equations. Further consideration leads to the fourth column in Fig. 1. Finally, consideration of mechanical systems in which the components rotate about fixed axes, gives the second column. Any one of the four systems in Fig. 1 is an analogy of any other because all four obey equations of the same form.

Whether a model or an analogue device, or neither, is used depends ultimately on convenience and cost, and therefore ultimately on cost alone. Whether a particular device is an analogue or a model can depend on circumstances; the network analyser is used to model other networks but can be an analogue of a mechanical system.

Blackburn Analyser

The next analogue device to be considered is the Blackburn analyser[3, 4] which is primarily employed as an a.c. network analyser. In place of the resistors, inductors and capacitors of the conventional analyser there is a set of variable ratio transformers (fitted with error-correcting electronic compensators). It cannot be used for the

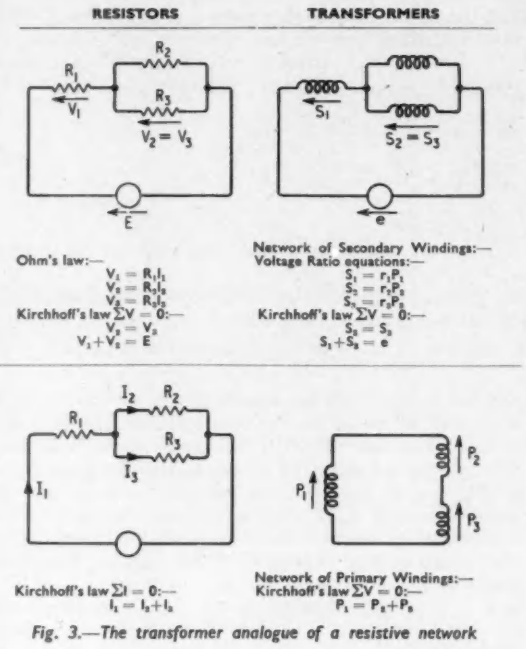


Fig. 3.—The transformer analogue of a resistive network

direct study of transient responses but is somewhat more versatile than a network model for steady-state studies because pure inductances and negative resistances can be simulated. Accuracy and capital costs are of the same order of magnitude. Some technical details of the largest installation of this type have been given in the *Electrical Review*.[5]

The principles involved are simple. The voltage-ratio equation for an ideal transformer and Ohm's law for a resistor (shown in Fig. 2) are similar in appearance. For an analogy to exist between a network of resistors and a network of transformers, the equations involved in interconnecting the components must also be similar. In the resistance network these are Kirchhoff's laws, namely $\Sigma V = 0$ round meshes and $\Sigma I = 0$ at nodes. If the transformer secondaries are connected up in a network, $\Sigma S = 0$ will apply to the voltages S in each mesh and be the analogue of $\Sigma V = 0$ if the network of transformer secondaries is a copy of the resistance network. The equations $\Sigma I = 0$ for the nodes of the resistance network and $\Sigma P = 0$ for the voltages around the meshes of the network of transformer primaries can only be analogies if they are the same in number and in form and this means that the transformer primaries must be connected up in a network which is the dual* of that of the resistors. There will be no interconnections between the primary- and secondary-winding networks except the magnetic couplings through the cores. On each transformer, the secondary voltage is the analogue of the voltage across the corresponding resistor, the primary voltage is the analogue of the resistor current and the turns-ratio r is the analogue of the resistance R.

The example in Fig. 3 in which the analogous quantities are exhibited side by side may clarify the general theory.

The analyser needs "ideal transformers" if it is to be accurate. The design technique which has been used so far is to make transformers with core losses, leakage reactance and winding resistance as low as possible. This results in rather low winding-inductances so that an electronic device is used to monitor the core flux and to supply all the magnetising current needed to produce this flux to an extra winding. The computing windings then carry hardly any current and the transformer appears nearly perfect; errors are of the order of 0·1 per cent of the maximum winding voltage.

To represent a.c. networks containing reactance and resistance, it is necessary to find an analogy of the equation

$$\mathbf{V} = \mathbf{ZI}$$

which involves vector quantities and replaces the simpler Ohm's law $V = RI$.

Writing $\mathbf{V} = V_p + jV_q$, $\mathbf{I} = I_p + jI_q$, $\mathbf{Z} = R + jX$, the equation becomes

$$V_p + jV_q = (R+jX)(I_p+jI_q)$$

which, after multiplying out the brackets and separating real and imaginary parts, gives

$$V_p = RI_p - XI_q$$
$$\text{and } V_q = XI_p + RI_q$$

By using two three-winding transformers of winding ratios 1 : R : X it is possible, as Blackburn showed, to make up units which correctly relate I_p, I_q, V_p, and V_q, all four of which are voltages on the analogue. Fig. 4 shows how this is done. The interconnection of these double transformer units to represent an a.c. network follows the same rules as before but there are now four separate networks, one for each in-phase component, V_p and I_p, and one for each quadrature component, V_q and I_q.

Another way of using a transformer assembly to simulate networks is to set up an analogue of the mesh equations, carrying out the additions and multiplications in them by using series connections of windings for additions and using transformer ratios as multipliers. When using the Blackburn analyser in this way,[4] it can be called a "transformer analogue computer" which emphasises the fact that direct consideration of computing or arithmetical operations is involved in the setting-up process. The most versatile analogue computers, however, are undoubtedly the mechanical, electromechanical and electronic analogue computers known as "differential analysers."

Electronic Differential Analyser

Differential analysers[6] are principally employed in solving dynamic problems describable by differential equations which may be linear or non-linear. In the electronic differential analyser,[7, 8] for example, all the problem variables except time are represented by voltages. These voltages vary with time in a similar way to the corresponding problem variables, the magnitudes being related by scaling factors. The time scales can be different so that the computer functions faster or slower than the system being simulated. Thus a process which is com-

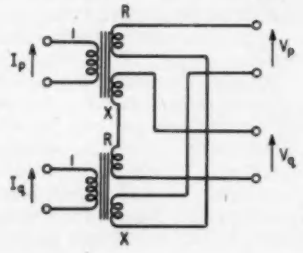


Fig. 4.—Impedance unit replacing the single transformer of Fig. 2. The winding ratios are 1 : R : X

* In a dual network, meshes change into nodes, series connections into parallel ones, and vice versa. In fact, the concept of duality is itself based on an analogy between the two Kirchhoff's laws which have the same mathematical form:

$$\Sigma I = 0 \text{ and } \Sigma V = 0.$$

This same analogy is given by the last two columns of Fig. 1.

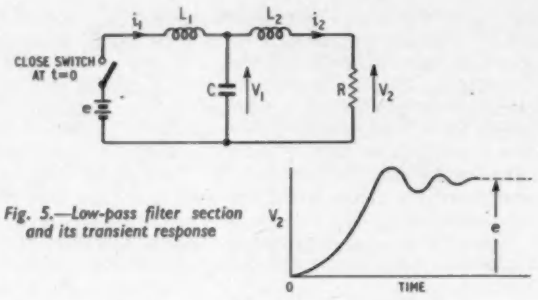


Fig. 5.—Low-pass filter section and its transient response

pleted in microseconds may have its analogue on the computer slowed down so that a record is obtained on a pen recorder. Alternatively, the time scale may be unchanged so that some real physical system can be joined to the computer, e.g. an automatic pilot can be tested safely on the ground by letting it "fly" an aeroplane which consists of a computer satisfying the differential equations of flight and being fed with signals representing wind gusts, etc. As an example of setting up a differential analyser, attention will be concentrated on the single problem of finding the transient response of a constant-k low-pass filter section, in which $L_1 = L_2 = \frac{1}{2}L$, terminated in its characteristic impedance $R = \sqrt{(L/C)}$ and shown in Fig. 5. The circuit can also be regarded as one section of a properly terminated artificial delay line, the nominal delay time being $\sqrt{(LC)}$. In the computer are a number of "black boxes" which can

(i) amplify or attenuate voltages;
(ii) add voltages together;
(iii) invert a voltage waveform;
(iv) integrate a voltage waveform with respect to time, the result being in the form of a time-varying voltage.

(In practice, some of the above operations are combined but this fact will be ignored for simplicity.) If Kirchhoff's laws are applied to the two meshes of the circuit in Fig. 5, and i_1 is eliminated from the mesh equations, the result will be the differential equation

$$\frac{d^3i_2}{dt^3} + \frac{R}{L_2}\frac{d^2i_2}{dt^2} + \frac{L_1+L_2}{L_1L_2C}\frac{di_2}{dt} + \frac{R}{L_1L_2C}i_2 = \frac{e(t)}{L_1L_2C}$$

In the computer, the variables e and i_2 will both be represented by voltages, E and I_2 respectively. The block diagram of a suitable arrangement of computing units is given in Fig. 6, in which the voltage I_2 satisfies the same differential equation as i_2. To see that this is true, the input to the first integrator, the voltage d^3I_2/dt^3, should be equated to the sum of the four inputs arriving at the adder on the left.

This arrangement of computing units has some disadvantages compared with the alternative arrangement derived below. First, in eliminating i_1 from the mesh equations, which is not a trivial operation, a mistake might be made. Second, the current i_1 and the voltage v_1 cannot be directly determined from the computer. Third, it is not possible to alter L, C and R *separately* to see the effects.

A superior arrangement, from the engineer's standpoint, is obtained by simulating the voltage-current relationships to each inductance, capacitance and resistance and then interconnecting these analogues as dictated by the network topology. In this case all the voltages and currents V_1, V_2, i_1, and i_2 are directly measurable as voltages on the analogue computer. Furthermore, the actual values of L_1, L_2, C, and R can all be altered (in the computer) and the effects of changing them can be observed. The details, starting from the first principles, are as follows.

The voltage (v) -current (i) relationships for inductance, capacitance and resistance are respectively:—

(a) $V = L\frac{di}{dt}$ or $i = \frac{1}{L}\int V dt$

(b) $V = \frac{q}{C} = \frac{1}{C}\int i dt$

(c) $V = Ri$

Then applying these to the components of the filter:—

$i_1 = \frac{1}{L_1}\int (E - V_1)dt$ for the first inductance, $L_1 = \frac{1}{2}L$

$i_1 = \frac{1}{L_2}\int (V_1 - V_2)dt$ for the second inductance, $L_2 = \frac{1}{2}L$

$V_1 = \frac{1}{C}\int (i_1 - i_2)dt$ for capacitance C

$V_2 = Ri_2$ for resistance R

These are simulated by the computing elements shown in Fig. 7 which have to be interconnected so that the outputs marked I_1, I_2, V_1, and V_2 are fed back to the corresponding inputs. For example, the output V_1 from the integrator representing C is fed back to the inputs marked V_1 on both the L_1 and L_2 integrators.

The step-function response can then be observed and the effect of altering the values of the components can be readily studied.

Conduction Analogue

The last analogy to be considered here is the conduction analogue. If an electric current (d.c. or low-frequency

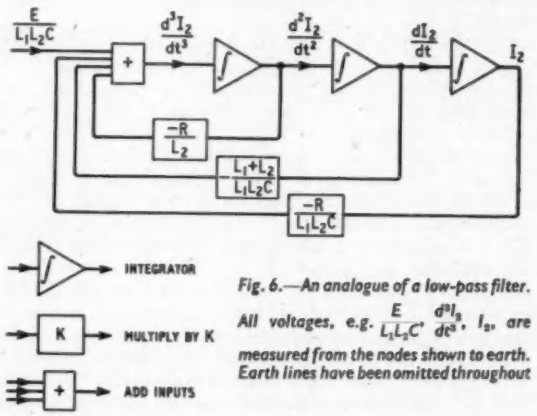


Fig. 6.—An analogue of a low-pass filter. All voltages, e.g. $\frac{E}{L_1L_2C}$, $\frac{d^3I_2}{dt^3}$, I_2, are measured from the nodes shown to earth. Earth lines have been omitted throughout

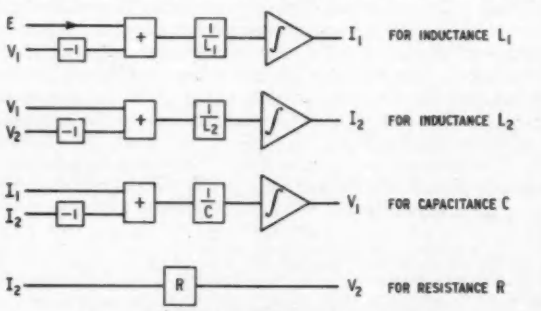


Fig. 7.—Improved analogue of a low-pass filter

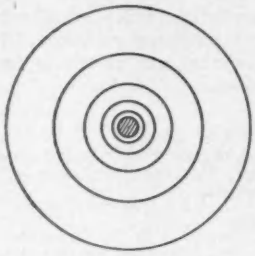


Fig. 8.—Electric equipotentials due to a current flowing radially out from a point source on a conducting sheet are the same as magnetic field lines around a long straight conductor

a.c.) flows in a three-dimensional conducting medium, the potential distribution V(x,y,z) obeys Laplace's equation:

$$\frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} + \frac{\partial^2 V}{\partial z^2} = 0$$

This system is simple to set up (particularly in two-dimensional forms on conducting paper,[9] or in the electrolytic tank[10] or on a resistance network[9]) and measurements of potential taken on it can be interpreted in terms of any other physical system to which Laplace's equation also applies. Such systems, which are either more difficult to set up, or to take measurements on than the conducting system, include the following:—

electrostatic fields— field distributions near high voltage electrodes and predictions of insulator breakdown; fields in electron tubes (in the absence of space charge); determinations of inter-electrode capacitances

fields of magnets— fringing flux in air gaps

magnetic fields of coil systems—determination of inductances and reluctances

electro-plating tank—determination of current density at electrode surfaces (this is *modelling* because the two systems are of the same kind)

steady-state heat flow—finding the temperature distribution inside electrical machines.

To justify these analogies, it is only necessary to show that Laplace's equation applies to them all and to find analogies between the various boundary conditions. An interesting case, with two alternative solutions, is that of the magnetic field produced by current-bearing conductors in the vicinity of iron. One analogy involves first replacing each current filament by an equivalent magnetic shell[11] whose magnetostatic potential obeys Laplace's equation. In the conduction analogue of this, electric equipotentials correspond with magnetostatic potentials and electric conductivity with magnetic permeability.

The alternative analogy is only valid for two-dimensional systems and is developed as follows. Consider the similarity between the electric equipotential lines around a point electrode on a conducting sheet and the B-lines of magnetic flux density around a long straight current-carrying filament. These are shown in Fig. 8 and in both the lines are concentric circles. It is quite easy to show that if the electric equipotentials are plotted at equal intervals of potential, they are analogous to magnetic lines drawn with equal amounts of magnetic flux, per unit depth, between them. Some further considerations are necessary, however, to establish a complete analogy.

(i) The superposition of currents flowing from a number of point sources on a conducting sheet is linear, and the superposition of magnetic fields due to a number of parallel current filaments is also linear, provided that the permeability does not vary with B. As an example, Fig. 9 shows the conducting analogue of the magnetic field due to two parallel conductors carrying uniformly distributed current in opposite directions, in air. A row of constant-current sources (pin electrodes fed through equal high resistances from the same battery) is used to simulate the uniform current distribution of the magnetic case. (If a strip electrode were applied to the conducting sheet and supplied at constant voltage, the current density would be greatest at the ends of the electrode.)

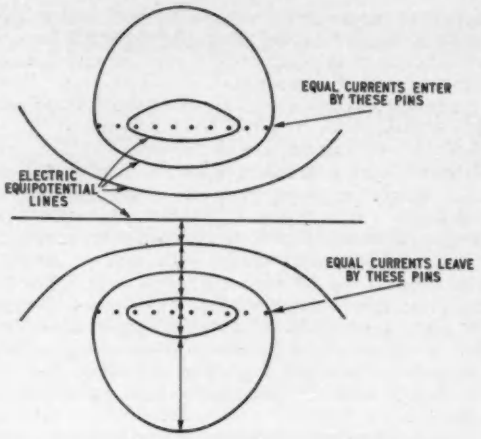


Fig. 9.—Conducting analogue of a magnetic field. The arrows embrace equal differences of electric potential (corresponding to equal quantities of flux in the magnetic case)

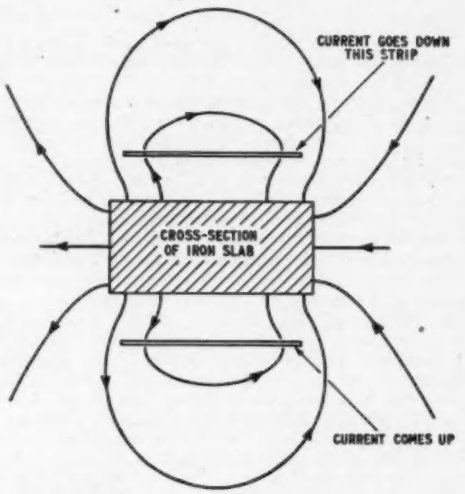


Fig. 10.—Magnetic field of current-bearing strips with an iron slab between. For the conducting-paper analogue, the part marked iron must be cut away and each strip electrode replaced by a row of pins, as in Fig. 9

(ii) At a perfectly insulating boundary, current flow is parallel to, and hence electric equipotentials are perpendicular to the edge. In the magnetic field, B-lines outside a region of high permeability are perpendicular to its boundary. Thus iron, when of approximate infinite permeability, is represented by an insulator. Fig. 10 is a sketch of the magnetic field of the two current-bearing strips of Fig. 9 when a slab of iron is placed between them. In the conducting analogue, the current has to flow round

the sides of the insulating strip to get from one set of pin electrodes to another, and the equipotentials (everywhere perpendicular to the current-flow lines) represent lines of magnetic flux in the air space.

These analogies are useful, for example, in studying the magnetic field in the air gap of an electric motor.

Space is insufficient to describe non-electrical computing devices for solving electrical problems, or electrical computing devices for solving problems in other sciences and technologies. It is apparent, however, that models and analogues are valuable for the solution of many engineering problems. Their relationship with digital computers seems likely to be a complementary one, both having their uses. In engineering education, models and analogues must play a greater part in future teaching, their role being

(a) to mitigate the difficulties of remembering so many facts, in a world where fresh facts are being discovered every day, by exploiting analogies between different groups of facts;

(b) to use analogue computers to give students practice in applying mathematics to physical situations.

Modern conditions demand extreme specialisation but fortunately there are techniques which, while specialised in themselves, do assist, link and clarify many others. Of these, to adapt a well-known quotation, mathematics is the queen and analogy her handmaiden.

REFERENCES

[1] Charman, F. J. H., Thraves, J., and Walker, E. F. "Use of Scale Model Techniques in the Design of V.H.F. and U.H.F. Aerials." *Electronic Engineering*, **30**, 1958, pp. 498–501.

[2] Electrical Research Association. "The E.R.A. Network Analyser." Technical Report V/T 122, March, 1954.

[3] Humphrey Davies, M. W., and Siemon, G. R. "Transformer Analogue Network Analysers." *Proc. Inst. Elec. Engs.*, **100 (II)**, 1953, pp. 469–486.

[4] Barker, J. R. "Applications of a Transformer Analogue Computer." *Brit. J. of Appl. Phys.*, **7**, 1956, pp. 303–307.

[5] "Network Analyser." *Electrical Review*, 23 May, 1958, pp. 965–966.

[6] Soroka, W. W. "Analog Methods in Computation and Simulation." McGraw Hill. 1954.

[7] Wass, C. A. A. "An Introduction to Electronic Analogue Computers." Pergamon Press. 1955.

[8] Korn, G. A., and Korn, T. M. "Electronic Analog Computers." McGraw Hill. 1956.

[9] Liebmann, G. "Electrical Analogues." *Brit. J. of Appl. Phys.*, **4**, 1953, pp. 193–200.

[10] Kennedy, P. A., and Kent, G. "Electrolytic Tank, Design and Applications." *Rev. Sci. Instrum.*, **27**, 1956, pp. 916–927.

[11] Coulson, C. A. "Electricity" (4th Edn.), p. 95. Oliver & Boyd.

E.C.A. LIVERPOOL DINNER

CLOSER co-operation with all sections of the industry—manufacturers, wholesalers, trade unions and area boards—to ensure that there was continued progress, was urged by Mr. C. R. Waterhouse, vice-president of the Electrical Contractors' Association, at the annual dinner of the Liverpool Branch held at the Exchange Hotel, Liverpool, on 9th March. He was responding to the toast to the Association, proposed by Mr. C. C. Smith, the city lighting engineer and president of the Illuminating Engineering Society. Mr. W. E. Potter, who has been elected chairman of the branch for a further term, presided.

Mr. Waterhouse said that the private contractor and retailer, and more particularly the member of the E.C.A., was confident of his ability to serve the community. Members subscribed to the guarantee of work scheme, which was a safeguard to those concerned, and also supported the National Inspection Council. Private contractors recognised how important was the system of training, and at all times the member of the E.C.A. was anxious to encourage boys to become efficient craftsmen. The private retailer was anxious to supply a good after-sales service and recognised the difficulties which beset the ordinary consumer in the purchase of electrical appliances.

Mr. C. C. Smith said the Association had played a valuable and enterprising part in the phenomenal growth of the electrical industry in this country since the turn of the century. The standard of living was very much dependent upon our ability to export and there could be no doubt that in this effort British electrical manufacturers played their full part. They had exported goods to the value of approximately £224 million per annum over the last two years, and to do this there must obviously be a live and healthy home market. It was not generally appreciated that in regard to the home market, there would be no demand either for the millions of electrical appliances sold in this country today, or for the electricity they consumed and the plant required to produce this energy, were there not competent electrical contractors to carry out the necessary wiring in a proper fashion. One of the most praiseworthy of the Association's aims was that of promoting excellence in electrical installation work and suppressing on every possible occasion slipshod and poor quality work. Some 85 to 90 per cent of the total electrical installation work undertaken by private contractors in this country was performed by members of the E.C.A. In view of the high standards set for membership it would be a good thing for all concerned when the proportion became 100 per cent. The schemes which had been developed for the training of apprentices were comprehensive and admirable.

Left to right: Mr. C. C. Smith, Mr. W. E. Potter, Ald. H. Livermore (Lord Mayor of Liverpool) and Mr. C. R. Waterhouse at the E.C.A. Liverpool Branch annual dinner

In proposing the toast to the guests, Mr. J. Pinnington expressed the hope that electrical contractors could look forward to even greater liaison with architects. It was essential that electrical installations should be adequate and in accordance with the best modern practice. The cost of the electrical installation as a percentage of the overall cost of a building was small and any false economies on the drawing board could only result in expensive alterations at a later date.

The Lord Mayor of Liverpool, responding, said the Liverpool Branch of the E.C.A. was one of the largest and most active in the country. A great responsibility rested on the electrical contractor for the efficient and safe working of electrical installations in homes and factories.

Building Plant Exhibition

The annual Building Plant Exhibition organised by the Ministry of Works will be held for the first time in the London area this year. It is to take place on a 25-acre site at Greenford, Middlesex, from 10th to 17th June.

Transformer Insulation Levels

Author's summary of a paper entitled "The Selection of Insulation Levels and Tests for High-Voltage Transformers" which was read before the Supply Section of the Institution of Electrical Engineers on 25th March

By G. B. HARPER, M.I.E.E.

THE selection of a transformer insulation level, which is usually designated by the full-wave (1/50 microsec) impulse test voltage for which the windings are designed, depends mainly on three factors:—(a) The system voltage, which governs the continuous working stress on the insulation; (b) the form of system earthing, which controls the magnitude of over-voltage arising under system fault conditions and the type of winding insulation used; and (c) the degree of exposure to atmospheric (or switching) over-voltage involving consideration of the system arrangement and the forms of surge protection provided.

Choice of a suitable level therefore requires examination not only of the characteristics of the transformer, but also those of the system and thus forms part of the general problem of insulation co-ordination. This can be described as the process of correlation between the system characteristics, the insulation strength of its parts and the methods adopted for surge protection.

A pattern for the overall insulation strength of a transformer can be developed from examination of the different forms of impulse and power frequency voltage test and typical insulation characteristics. Such a pattern is illustrated in Fig. 1, which covers conditions associated with the British 132 kV and 275 kV grid systems based on test levels at present specified compared with levels one step lower in a standard table, i.e. 550 kV and 1,050 kV at present specified for the full-wave impulse voltage test against 450 kV and 900 kV.

Protective Devices

Either co-ordinating rod-gaps or surge divertors are usually provided for protection of high-voltage transformers. A rod-gap, although a cheap and simple device, has the disadvantage that its flashover characteristics are inconsistent; also, as the surge and power follow current is directly discharged to earth, disconnection of the transformer is involved. Comparison between typical volt/time characteristics for transformer insulation and rod-gaps shows higher breakdown values for short time durations in respect of the latter with consequent reduced protection against steep-fronted waves. Surge divertors provide more uniform performance as their spark-over and discharge characteristics are controlled. As a manufactured item of plant, however, a surge divertor is more expensive and inherently less reliable than a rod-gap. Further, due to the material used in its construction, silicon carbide, a surge divertor also has a limited thermal capacity such that it is necessary to ensure operation does not occur during either normal or abnormal increase in the system voltage, and selection of an appropriate rating is consequently dependent on system earthing conditions. Providing reliable divertors with suitable characteristics for the system conditions are available, their use can permit selection of a lower transformer insulation strength than that necessary with rod-gaps. The use of divertors, however, involves increased capital expenditure and this needs to be considered relative to any saving in reduced transformer insulation and avoidance of plant outage.

Surge protection of transformers associated with the British 132 kV and 275 kV grid systems is provided by rod-gaps except for transformers directly connected to generators, where divertors are installed to avoid loss in output, and special cases, e.g. transformers connected to wood pole lines. Analysis of transformer faults for the 132 kV system over the ten-year period 1948 to 1958 indicates a total of 13 due to lightning and seven due to switching operations which, expressed as faults per 100 transformers per annum, amounts to an average of 0·25 and 0·13 respectively. Of these incidents the majority were associated with transformers over 20 years old whose insulation strength is inferior compared with modern designs. In a number of cases, these faults did not result in permanent insulation damage. No similar faults have been experienced with the 275 kV system which has been in operation for a shorter period and where all transformers are of a modern impulse tested design. The low fault rate with the rod-gap settings at present used, i.e. 26in for the 132 kV system and 48in for the 275 kV system, cannot, however, be taken as a direct

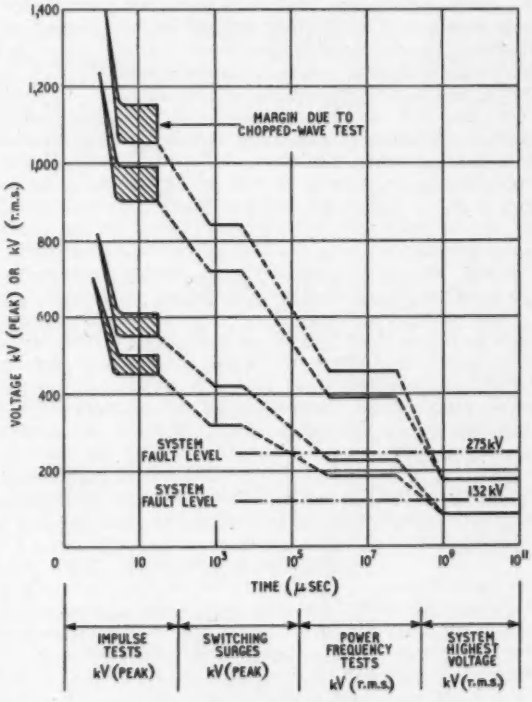


Fig. 1.—Transformer insulation characteristics

criterion of the efficiency of this form of protection and due account must be taken of the natural shielding provided by the system and associated connections. A general appraisal indicates that no advantage would be gained for British conditions by a change in the methods of surge protection employed.

Transformer test procedure at present specified covers impulse voltage tests, as type tests and power frequency voltage tests on a routine basis. Whilst the former, associated with suitable surge protection, corresponds to conditions which can arise in service, the latter bears no similar relationship giving rise to stresses somewhere between those due to switching and those resulting from system fault conditions, see Fig. 1. When consideration is being given to revision of transformer test procedure. therefore, the following may merit examination:—(a) Ir·pulse tests on a routine basis; (b) a test corresponding to switching over-voltages; and (c) a reduced power frequency test at a value showing reasonable margins over the system fault level, as a routine test.

Adoption of the above would leave the transformer designer free to develop an insulation structure directly related to system requirements without possible anomalies dictated by arbitrary test values.

The author is indebted to the chief transmission engineer of the Central Electricity Generating Board for permission to publish the information given in this paper.

Developments in Electrical Engineering

Summary of a paper entitled "New Methods, Materials and Techniques in Electrical Engineering" by Mr. H. G. Taylor, D.Sc.(Eng.), M.I.E.E., F.Inst.P.* read before the Association of Supervising Electrical Engineers on 24th March

MANY new insulating materials have become available during the past few years following on major advances in the synthesis of polymers. Since much practical insulation is of a composite type, an increase in the number of basic materials has led to a much greater increase in the choice of available combinations. The paper gives details of various new and improved insulating materials.

An interesting recent Russian development is the insulation of wires with a film of glass. The wire and glass covering are remarkably uniform in diameter and the core is concentric. A wire of about 0·004in diameter with a coating of similar thickness can be bent to a radius of about 1 mm without the glass coating shattering. The wire can withstand a temperature of about 800 deg C before the glass begins to flow.

Single- and double-grain-oriented silicone steel for magnetic circuits is the most significant development in other materials. The effect of the use of such silicone steel for transformers is to reduce the size for a given rating and to reduce the losses. There is some dispute as to the value of double-oriented steel for practical applications, but it is an innovation of considerable scientific interest and one which may have a considerable effect on transformer and machine design.

The normal method of air cooling of alternators reaches its practical limit in the region of 150/200 MW. The limits are created by the size of a sound forging which can be obtained for the rotor and by the weight of the largest single part which can be carried by road. In Great Britain this means about 150 tons. To obtain greater output from a given frame size, the specific loading must be increased. The maximum permissible temperature for the insulation then becomes a limiting feature. The only practical solution is to provide direct cooling of the windings.

The first stage in the direct cooling of alternators was the substitution of hydrogen for air as the cooling medium. Hydrogen has superior cooling qualities and results in lower windage losses. Its cooling properties are also improved by increasing the pressure and an early step was to increase this pressure from 0·5 p.s.i. to about 40 p.s.i. Direct cooling of the rotor conductors was the next stage. Tubular conductors can be used or conductors so shaped that, when placed in the slots, they form tubular passages through which the hydrogen coolant can flow.

Hydrogen may also be used for cooling the stator conductors in the same way, but additional complications arise from the need to transpose conductors. Perhaps the most advanced development is the use of water cooling for stator windings. The heat transfer is improved by using water cooling as compared with hydrogen and less power is used in pumping the coolant through the hollow conductors. Following the direct cooling of stators, rotor temperature rise would now appear to be the limiting factor, so that the liquid cooling of rotors would appear to be a future possibility.

The paper then refers to off-peak floor heating, and a brief description of the basic design requirements is given.

For power transmission and distribution, a.c. has been used for the last 70 years. Direct current offers the advantage of high transmission capacity over a given overhead line and is particularly suitable for long-distance transmission. The working stress of a.c. cables is about 10 kV/mm and this can be raised to about 30-40 kV/mm for d.c. cables. This, together with the fact that a d.c. cable does not have any charging current, makes d.c. economically competitive for relatively short cable connections.

In recent years three new methods of connecting conductors have been introduced. One is cold pressure weld, which has particular application to aluminium busbars; another is the helical spring connection, which is of special application to overhead lines; and the third is the twisted wire, primarily of use in telephone exchanges.

The paper describes one means of detecting harmful organic impurities in dielectrics and an automatic method for determining the comparative tracking index for insulating materials. New and improved methods of detecting the condition of insulation are also described and the paper concludes with a reference to the use of the E.R.A. network analyser and to computers for the design of electrical plant.

* Director, Electrical Research Association.

Economics of Power Station Design

REVIEW OF RECENT TRENDS

THE modern pattern of thermal power station development in the United Kingdom was described by Mr. J. T. Moore (Ewbank & Partners) at the World Power Conference (Canadian Sectional Meeting) as based on a compromise between many economic influences. These included capital availability, fuel supplies, suitable sites, transport limitations and centralised control of the generating system. An outstanding feature was heavy interconnection between power stations, which enabled over two-thirds of the kWh output to be produced by the more economical plant forming less than half the total kW capacity.

Conventional power stations to be operated at high load factors were built near coalfields (except in the London area (necessitating total or part dependence upon cooling towers for circulating water for the condensers. Nuclear power stations, for which a high load factor was essential on account of their higher capital cost and for technical reasons, were being erected near the coasts to secure the more ample supplies of condensing water they needed.

Lower Capital and Operating Costs

Increase in individual ratings of generating sets (associated inherently with higher steam conditions), coupled with the unit system of one boiler-one turbine and with the reheat cycle, for which a further improvement in thermal efficiency was obtainable without appreciably increasing first cost, had resulted in the progressively lower capital and operating costs indicated in the accompanying table. The reduction in capital expenditure had

Standard Generating Units in the United Kingdom since 1948

Unit Size	Inlet Conditions		Exhaust Conditions	Final Feed Temp.	Thermal Efficiency	Cost per kW installed (at 1957 prices)
MW	lb/sq in	Deg F	In Vac.	Deg F	Per cent	£
30	600	850	28·8	330	27·4	75·47
60	900	900	28·8	385	30·8	61·91
100	1,500	1,050	28·9	400	33·4	57·91
120 reheat	1,500	1,000/1,000	28·9	435	35·1	54·15
200 reheat	2,350	1,050/1,000	28·9	460	37·0	50·00
275 reheat	2,350	1,050/1,050	28·9	486	37·5	Less than 50
550 reheat*	2,350	1,050/1,050	28·9	486	37·8	Less than 50

* Cross-compound units.

been achieved despite the general rise in costs during the past ten years. Moreover, the number of generation employees per MW of output capacity had fallen during the same period from 2·74 to 1·86 and was expected to be less than unity for the larger stations in the present programme.

The influence of a policy of "evolution by steps" in unit capacity apparent in the table was based upon the exploitation of any advance in design of steam generator, turbine or alternator to the maximum extent rather than the adoption of frequent smaller steps in which the anticipated economic return might not be fully achieved. For example, if above 1,050 deg F austenitic steels were needed instead of ferritic steels, the next stage would be to go to appreciably higher temperatures to justify the additional cost. It would also be uneconomic to design double combustion chambers for only a slightly greater output than the 120 MW which was at present about the limit for the single construction. Apart from the lowering of plant costs effected by evolution by steps, the associated civil and building work had been lessened; whereas a typical station having six 30 MW sets required 39·4 cu ft/kW, one with five 200 MW sets required only 27·8 cu ft/kW.

Flexibility of operation under two-shift working (for which the largest machines now projected were designed) was required especially by the steam generators. Burning high-chlorine coals without excessive fouling called for a determination of the best arrangement of heating surface. Steam conditions of 1,050 deg F and 2,350 lb/sq in at the turbine inlet were the highest values reasonably possible without encroaching on the still largely unexplored critical region.

The main limitation to the size of individual generating sets was the shipping weight of the alternator stator, but recent developments, including hydrogen cooling under pressure, had raised the transport range from 120 MW in 1954 to 200 MW at present and 275 MW after 1963.

In the principal stations under construction auxiliaries were self-contained as regards each generating unit except for water supplies, which were usually arranged for full station demand. While cooling towers in service were of natural-draught reinforced-concrete construction, the C.E.G.B. had ordered an experimental 120 MW "dry-type" installation using jet condensers, the water to be cooled being pumped in a closed circuit through heat exchangers fitted round the tower base. The whole of the waste heat was transferred to the air passing up the towers, instead of being dissipated by evaporation of water. This would entail circulation of more than three times as much air as the usual type. The extra cost entailed by the larger structures might be offset by extraneous savings in water-scarce areas. With an increasing adoption of steel-framed buildings and lightweight cladding there was no general trend towards outdoor or semi-outdoor stations.

Pulverised-fuel Furnaces

Dry-bottom furnaces for the pulverised-fuel-fired steam generators were almost always adopted because of their ability to deal with wide variations in fuel characteristics, moisture, ash content and ash fusibility, even when burning mixed varieties of high-chlorine Midland coals. For two-shift operation superheat and reheat control was obtained through a combination of radiant and convection surfaces, which gave a flat temperature curve, and by means of attemperators and by damper control of reheat temperatures.

To facilitate the disposal of fly-ash two 120 MW reheat units with wet-bottom furnaces had been ordered by the C.E.G.B., one with conventional p.f. firing and a slag-tap furnace and the other for cyclone firing.

All steam turbines were now designed for throttle governing with the economical rating coincident with the maximum rating. Alternators of 60 to 120 MW were hydrogen cooled, both rotor and stator. For 200 MW sizes either the conductors in both components were in direct contact with the hydrogen or else rotor cooling was by hydrogen and stator cooling by distilled water.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The following staff changes in their Research Group are announced by the United Kingdom Atomic Energy Authority:—**Mr. D. W. Fry** has been appointed director of the Atomic Energy Establishment, Winfrith. He is at present deputy director of the Atomic Energy Research Establishment at Harwell. **Mr. F. A. Vick,** O.B.E., Ph.D., head of the Department of Physics at the University College of North Staffordshire, has accepted an appointment as deputy director of the Atomic Energy Research Establishment at Harwell and will take up his post later this year. Both these Establishments will remain within the Authority's Research Group under the charge of Dr. B. F. J. Schonland, C.B.E., F.R.S., director of the Group.

Mr. G. L. Bailey, C.B.E., M.Sc., F.I.M., Director of the British Non-Ferrous Metals Research Association, has been elected president of the Institute of Metals.

Mr. J. Raymond, chairman of Stone-Chance, Ltd., and Hayward Tyler & Co., Ltd., and president of Sumo Pumps, Inc., is at present on a visit to North America and the West Indies in connection with the interests of all three companies.

Atlas Lighting, Ltd., announces the appointment of **Mr. G. W. H. Smith,** A.M.B.I.M., M.S.M.A., as sales training manager. Mr. Smith has considerable experience in the fields of selling and sales management and before joining Atlas was general sales manager with Sandhurst, Ltd. Previously he was divisional sales manager of Caribonum.

Mr. G. W. H. Smith

Mr. J. G. Dawson, B.Sc., M.I.Mech.E., M.Inst.F., A.F.R.Ae.S., has been appointed directo. of engineering of F. Perkins, Ltd., and **Mr. G. Smith,** M.A.(Cantab.), A.M.I.Mech.E., A.M.I.E.E., has been appointed director of production.

Mr. Dawson is at present general manager of the company's engineering division, and is also a director of Perkins Outboard Marine, Ltd.

Mr. Smith has been personal assistant to Mr. M. I. Prichard, the managing director, since he joined F. Perkins, Ltd., in 1957. He went to the English Electric Co. from Cambridge University in 1944 as a graduate apprentice and became a diesel-electric and electric railway traction engineer. In 1948 he joined the Buenos Aires Western Railway in Argentina as assistant rolling stock superintendent of the railway's electrified section. He returned to England to join the Brush Group in 1950 as contracts manager of the rail traction division, becoming works manager of the transformer division at Loughborough in 1954 and in the following year was appointed works manager of the electric machines division.

Lord Hailsham, Lord President of the Council, on 18th March presented the Wolfe Award in the form of a cheque for £500 to **Mr. L. Essen,** O.B.E., D.Sc., Ph.D., A.M.I.E.E., at the Privy Council office. This is the first of ten annual awards to be made, under the terms of a will, to the research worker who is considered by the Department of Scientific and Industrial Research to have made an outstanding contribution to the research work of the Department during the previous twelve months. Dr. L. Essen, a senior principal scientific officer at the National Physical Laboratory, was selected for the award on account of his work on the establishment of an atomic frequency standard as a basis for the future standard of time.

Mr. L. J. Cox has been appointed chief of the Public Relations Department of Wolf Electric Tools, Ltd. Mr. Cox joined Wolf's thirteen years ago and has served successively as manager to the export, home sales and publicity departments.

Mr. E. Patterson has been appointed technical liaison officer. In addition to internal technical committee work he will represent the company on all British and international technical committees. Mr. Patterson joined Wolf's in 1956 as technical and market research adviser, having previously been technical director to Domestic Engineering, Ltd. Earlier, he was with E.M.I.

Mr. N. R. Broome has been appointed senior lighting engineer in the Illuminating Engineering Department, London, of Ekco-Ensign, Ltd.

The Lancashire Branch of the **Electrical Association for Women** celebrated its 21st birthday recently when an anniversary dinner was held at Preston. The president, Mrs. G. A. Robertson, was in the chair. The civic toast was proposed by Mr. H. E. Rhodes, J.P., and the response was made by the Mayor of Preston, Mrs. M. A. Wignall, who was accompanied by the Mayoress, Mrs. E. Muir. The toast of the Association was proposed by Mr. T. E. Daniel, M.Eng., M.I.E.E., chairman, North Western Electricity Board, and Miss Mary George, M.B.E., director of the E.A.W., replied. Mrs. W. Coward, Branch chairman, proposed the toast of the guests and Mrs. I. Harling, chairman of the E.A.W. Area Federation, responded.

Mr. M. H. J. Hammill, B.Sc.(Eng.), M.I.Mech.E., has joined the board of the John Morris Electrical Engineering Co., Ltd., and has been appointed managing director of the company and its associated companies as from 1st April. He has hitherto been managing director of Foster Transformers.

Mr. M. H. J. Hammill

Pleas to householders in the older types of property to have their electrical appliances and wiring checked more frequently were made by two speakers at the annual dinner-dance of the North Worcestershire and Staffordshire Branch of the **Electrical Contractors' Association** held recently at the Station Hotel, Dudley. Mr. R. A. Joseph, vice-chairman of the Midland Sectional Board, said it was part of the Association's job to protect householders wherever possible. The theme of safety was developed by the chairman, Mr. E. A. Roberts, when he proposed the toast of the guests. He said that in many cases the load on the installations in older property had increased considerably and owners should think seriously about it. The deputy chairman of the Midlands Electricity Board, Mr. G. F. Peirson, proposing the toast of the Association, said the M.E.B. was engaged in a vast expansion programme and it was connecting some 35,000 new consumers every year. The consumption of electricity would double in ten years and he promised there would be plenty of work for all members of the Association.

Mr. L. C. Burke has been appointed chairman of Standard Telephones & Cables (S.A.) (Pty.), Ltd., Johannesburg. Mr. Burke, who was born at Claremont, Cape Province, took his degree of Bachelor of Economics at Transvaal University College, Pretoria. After serving in East Africa and Europe in the 1914-18 war, he continued his career in the public service of the Union, his last appointments being Provincial Secretary, Natal (1940-43), and Postmaster General (1943-58). He played an important part in the post-war development of telecommunication services in the

Union, including the taking over by the Government in 1948 of the privately owned Cable & Wireless Co. of South Africa. He also played a leading role in the conclusion of various international agreements and represented South Africa at the Commonwealth telecommunications discussions in London in 1945 and 1957. Standard Telephones & Cables (S.A.) (Pty.), Ltd., is a subsidiary of Standard Telephones & Cables, Ltd., London.

Many readers will be glad to know that **Mr. and Mrs. J. W. Burr** are today celebrating their diamond wedding anniversary. Mr. Burr, who is in his 89th year, was borough electrical engineer of Swansea for 25 years; he retired about 20 years ago.

Mr. Peter Thorneycroft, P.C., M.P., was recently appointed a director of the Pirelli-General Cable Works, Ltd.

The National Inspection Board has elected **Mr. C. T. Melling,** C.B.E., as the chairman of the National Inspection Council for Electrical Installation Contracting for 1959-60 and **Mr. S. E. Goodall** as the deputy chairman. Mr. Melling is a member of the Electricity

Mr. C. T. Melling

Mr. S. E. Goodall

Council and [illegible]man of the Eastern [illegible]m 1947 to 1957.

Mr. Goodall is a director and chief engineer of W. T. Henley's Telegraph Works Co., Ltd. He is also this year's President of the Institution of Electrical Engineers, and is their nominee on the board of the National Inspection Council.

Mr. P. H. Leyton has been appointed director of engineering of Black & Decker, Ltd. Mr. Leyton has been with Saunders-Roe, Ltd., where, as chief rocket development engineer, he was responsbile for directing the development trials and successful launching of "Black Knight," Britain's first ballistic rocket. He will take up his new appointment on 1st April.

The annual dinner of the **Royal Commercial Travellers' Schools** was held at the Trocadero Restaurant, London, on 20th March. In the absence through illness of the Hon. David Smith, the President of Appeal, the dinner was presided over by Mr. Leslie Gamage, the Schools' president. The toast of the Schools was proposed by the principal guest, Mr. Aidan Crawley, who said he thought there was too much emphasis today on technical education. This country used to export administrators. What we now required were "robust individuals" who understood business and trade and in providing these the Schools played a valuable role.

At the recent annual dinner-dance of the Merseyside and North Wales Centre of the I.E.E. held at Port Sunlight. Included in the picture are Mr. J. Collins (chairman) and Mrs. Collins, Mr. J. A. Prescott (chief switchgear engineer, English Electric Co., Stafford) and Mrs. Prescott, Mr. J. A. Spence (C.E.G.B). and Mrs. Spence, and Mr. and Mrs. J. Tegid Jones

Mr. Cyril Harvey, chairman of the Board of Management, said in his reply that they were happier than at any time since the war in the general life and administration of the Schools, but there was scope for an improved academic standard. The pattern of the future would involve admitting more fee paying children. The 113th Maintenance Appeal realised £45,200 12s and this was brought up to £45,500 by a cheque presented during the dinner by Mr. Leslie Gamage.

Sir Ben Bowen Thomas, Permanent Secretary to the Welsh Department, Ministry of Education, last week addressed the apprentices of **Hoover (Washing Machines), Ltd.,** at Merthyr Tydfil, Glamorgan, on the occasion of the annual apprentices' evening when, in the presence of relatives and friends, prizes were presented to mark stages in the apprentices' progress.

Mr. E. M. Lee, B.Sc., M.I.E.E., M.Brit.I.R.E., Fellow of the Television Society, is the new president of the Radio and Electronic Component Manufacturers' Federation and succeeds Major L. H. Peter in that office. Mr. Lee, who has been managing director of Belling & Lee, Ltd., since its foundation in 1922 and a director of Insulators, Ltd. (Plastics), was one of the founder members of the original R.E.C.M.F., and has been chairman of the Council on two occasions. He was elected a life vice-president many years ago. During the war Mr. Lee was chairman of the Joint Industries and Services Technical Components Committee. He is chairman of the Radio Trades Examinations Board.

Mr. E. M. Lee

Mr. D. M. Cherry, B.Sc., M.I.E.E., has been appointed transmission plant and equipment design engineer at the headquarters of the Central Electricity Generating Board to fill the vacancy created by the resignation of **Mr. A. J. Gibbons.**

Mr. Cherry served apprenticeships with the Auckland Electric Power Board and the Metropolitan-Vickers Electrical Co., Ltd., Manchester, joining the Switchgear Engineering Department of the latter in 1937. In 1940 he joined the Operation Department of the former Central Electricity Board, and in 1946 became switchgear engineer in the Technical and Research Department of the Board. He remained in this capacity when the department became the Transmission Design Branch of the B.E.A. and its successors, and was responsible for the development of standardised substation layouts in the post-war construction period. In 1954 he became the substation plant engineer in the Transmission Design Branch.

Mr. D. M. Cherry

Mr. M. H. Shepheard

Mr. M. H. Shepheard, B.Arch., A.R.I.B.A., has been appointed architect on the staff of the Board in the Chief Design and Construction Engineer's Department at headquarters.

His duties will be to advise the Board on the architectural aspects of its activities which include the construction of new power stations, switching stations and transmission

At the I.E.E. Scottish Centre dinner. Left to right: Mr. S. E. Goodall (President), Mr. R. J. Rennie (Centre chairman) and Mr. W. K. Brasher (secretary, I.E.E.). Seated: Mrs. Brasher, Mrs. Goodall and Mrs. Rennie

lines. He will also act as secretary to a panel of consulting architects under the chairmanship of Sir William Holford, and will also be responsible for furnishing guidance to and maintaining liaison with the executive architects dealing with individual major projects.

Mr. Shepheard is a graduate of the School of Architecture at Liverpool University and the major part of his time since the war has been spent in private practice, although for three years he was on the staff of the Basildon New Town Development Corporation. At one time a junior partner in the firm of Bridgwater and Shepheard, he has also gained industrial experience in the office of Hugh D. Roberts in Bath, and joins the Generating Board from the office of Sir Giles Scott, Son & Partner.

Mr. J. T. Masterton, managing director of Brown Brothers, Ltd., since 1951, has now been appointed to the additional office of deputy chairman of the Brown Brothers group of companies.

Mr. J. T. Masterton

The next production of the **Portland Players** (drawn from the Electricity Council and the Central Electricity Generating Board) will be "Here We Come Gathering," a farce by Philip King and Anthony Armstrong, which will be presented at King George's Hall, Adeline Place, Great Russell Street, W.C.1, on 13th and 14th April.

The annual dinner of the Scottish Centre of the **Institution of Electrical Engineers** was held on 19th March at the George Hotel, Edinburgh, Mr. R. J. Rennie (chairman) presiding. The toast to the Institution was proposed by Captain A. J. F. Milne-Home, R.N. (chief of staff, flag officer, Scotland), who said that Britain's lead in inventive genius and independence of thought was due largely to the work of members of the Institution. He hoped that members would bear in mind the ever-present need of developing the theoretical advances. Mr. S. E. Goodall, the President, replied in a witty speech and paid tribute to the work of the permanent staff of the Institution. The chairman of the South-West Scotland Graduate and Student Section is Mr. R. M. Rennie, son of Mr. R. J. Rennie, and he spoke about the activities of his Section. Mr. W. K. Brasher, the secretary of the Institution, told members of the need to train more graduates in technology and stated that the U.S.S.R. was in a position to turn out 200,000 graduates per year by part-time training and that these graduates would not fall short of the standards we set in Britain. He also mentioned that he was happy to see that the Scottish Centre was inviting the Institution to visit Scotland in 1960, the occasion of their diamond jubilee.

OBITUARY

Professor J. T. MacGregor-Morris.—The death occurred on 19th March at the age of eighty-seven of Professor J. T. MacGregor-Morris, D.Sc.(Eng.) (Lond.), Emeritus Professor of Electrical Engineering, University of London. He was a Fellow of both University and Queen Mary Colleges.

Professor MacGregor-Morris received his education at University College, London, and from 1894 to 1898 he was assistant to Professor (later Sir) Ambrose Fleming at University College. In the last-mentioned year he became head of the Electrical Engineering Department of Queen Mary College, a position he held until his retirement in 1938. He specialised in subjects connected with illumination. In 1915 he carried out experiments with Mr. A. E. Sykes in submarine detection, which resulted in the production of a directional hydrophone used during the 1914-18 war. He was also the inventor of a portable direct-reading anemometer. During the years 1925-28 he was director of the Electrical Engineering Section of the Summer School for Engineering Teachers, and in 1928 he was the I.E.E. delegate at the International Commission on Illumination in America. He carried out a great deal of work on photometric standards, ferro-magnetic materials and the early development of the cathode-ray oscillograph.

Professor MacGregor-Morris was a past-president of the Illuminating Engineering Society, which honoured him in 1952 by making him an honorary member of the Society. He was also a past-chairman of the I.E.E. Measurements Section. His literary contributions to scientific societies and the technical Press covered illumination generally, magnetic testing, domestic electric heating and cooking, and other subjects.

Mr. J. R. Greenwood, chairman and managing director of Craven Brothers (Manchester), Ltd., died on 14th March at his home in Cheadle, Ches. Mr. Greenwood was managing director of the company from 1929 and became chairman and managing director in 1936.

Seal of Safety

The British Safety Council has launched a new scheme for approving equipment, products and appliances as "safe." The seal must be earned by the equipment and cannot be bought by the manufacturers. When the scheme is in operation a manufacturer will submit his product for testing, which will be carried out by selected independent laboratories. If the product meets the high standards of safety set by the Council, the manufacturer is awarded the certificate and seal of approval. Either of these may be used in advertising and promotional material and, further, may be stamped on the product itself. Periodic tests will be carried out by the British Safety Council's purchasing items of the approved article from a retailer and testing them. This will help to ensure that high standards are maintained. The Council has already had a number of items submitted for approval, including electric blankets and fires.

British Safety Council's seal

Insulator Companies' Amalgamation

The boards of Taylor Tunnicliff (Electrical Industries), Ltd., and Bullers, Ltd., jointly announce that they have agreed on proposals for an amalgamation of the two companies by means of a holding company.

INDUSTRY AND THE HOUSE

Unemployment and the General Election

By ARTHUR PALMER, A.M.I.E.E., M.Inst.F., M.P.

THE coming General Election is casting at Westminster a long shadow before it; our debates become increasingly designed to influence votes at the poll and less to serve a direct parliamentary purpose as such. I think this to be perfectly legitimate. After all, today the general run of public affairs is a tedious and complicated business and we can almost forgive the ordinary man if he turns his back on it. Parties by concentrating attention on the black and white issues help to make it easier for him to decide one way or the other.

I have said before that I consider unemployment will be an important domestic issue at the General Election; not so much because the actual level in the United Kingdom is particularly high compared with other industrial countries in the free world but rather that it is a question of tendency or trend. If the electors sense that unemployment will probably continue to grow with one set of rulers in office many will think that a good enough reason for not supporting that particular party. This factor was, I expect, in the minds of the leaders of the Parliamentary Labour Party when they launched their attack on the Government last Thursday for alleged failure to prevent " the recent substantial and widespread rise in unemployment." They were anxious to convey an impression that unemployment and short time working in industry were rather more likely to be associated in practice with Conservative than Labour Governments at Westminster. In this Messrs. Jay and Robens might well have succeeded in the ordinary way but they did not allow for the sheer horse-sense of the present Minister of Labour, Mr. Iain Macleod. Now, I must agree, as a political opponent of Mr. Macleod's, that he has a great gift for making anything he is doing seem to be the most reasonable and obvious course that could possibly be conceived. He has no outstanding talent for picturesque or original language but he can express ideas to convey meaning with a great economy and force of words. Also, in Thursday's debate in the House of Commons he was lucky with his facts.

Recent Improvement

Although unemployment is greatly up compared with twelve months ago, it so happens that over the last month there has been a reduction of 58,000. The Minister brought this improvement out in a hard-hitting speech displaying with justified confidence his cool facility—he is an ex-bridge champion—for keeping figures in his head without recourse to notes. Arguing that British unemployment was mainly a national aspect of a wide trade recession in the western world, Mr. Macleod gave the latest unemployment percentages as: Canada 8·9; Italy 8·9; Denmark 8·3; Belgium 7·2; United States 6·1; Western Germany 5·6; Sweden 4·3; Norway 4; Netherlands 3·2; and coming last of all to the United Kingdom he proclaimed this to be the lowest of the lot, standing now at 2·5 per cent while a month ago it was 2·8 per cent.

Earlier Mr. Macleod had attempted to belittle the pamphlet prepared recently by Mr. Jay on behalf of the Labour Party which suggests detailed remedies for dealing with obstinate pockets of workless in various parts of the country. The Minister did not dispute the value of Mr. Jay's ideas, but argued that there was no need for him to do so since the policies demanded were already the policies of the Government. For instance, he said, the only essential differences over the building of advance factories was the number: Mr. Jay's pamphlet had suggested six; the Government thought three would make a reasonable start; that was a difference not of principle but simply of extent.

On industrial development certificates Labour's author had argued " any new factory or extension which can reasonably go elsewhere should be steered away from the congested areas." Mr. Macleod was generously prepared to accept that as a very clear outline of what the Government was doing. No new factory was normally given a building consent in the Greater London area and the best of all results was that there should be a new factory or new extension to a factory in a development area. Yet the second best result was still that the factory or extension should at least be built somewhere. The worst of all possible answers would be an absolute refusal to grant a development certificate. This could mean that the new factory or extension did not take place at all and the economy of the country would be thereby the weaker for it. Anyhow, contended Mr. Macleod, it was unrealistic, taking all in all, to pretend that there was a radical or dramatic difference between the Labour and Conservative Parties on unemployment remedies.

Opposition's Views

Mr. Jay, in opening for the Opposition, had argued there was no reason for over half-a-million people to be unemployed and that short time should now be worked in many parts of the country. A policy of extreme financial deflation had been followed by the Government since September, 1957, at a time when stimulation rather than the reverse was necessary. The National Institute of Economic Research had calculated that 10 or 15 per cent of Britain's productive capacity was now idle. Whatever the real figures there could be no question that a huge reservoir of skill, training and experience was running to waste. Deflation struck " a crushing blow " at the whole movement for greater British productivity and economic use of manpower.

Members who took part in the debate were mainly from areas where unemployment is very high; for instance Lady Megan Lloyd George, who is Member for Carmarthenshire, and Scottish Members such as Mr. Wolridge-Gordon of East Aberdeenshire—making a maiden speech —and Mr. Hoy of Leith. As was to be expected in the circumstances, there was a great deal of justifiable constituency pleading.

The debate was wound up by Mr. Alfred Robens for the Opposition and Mr. John Rodgers, fairly recently the new Parliamentary Secretary to the Board of Trade. Mr. Robens said that unless the Government acted to ensure that work was taken into the worst-hit areas the country would never have full employment because there was a natural limit to the amount of migration that could occur. If all those out of work in the black spots " trekked back " to where employment prospects were good there would be a complete social upheaval. The Opposition's major com-

plaint was that by their own folly the Government had brought about an inflationary situation and had only been able to meet it by producing unemployment.

Mr. Rodgers, I am afraid, did not make a particularly successful speech. He had all the facts in a voluminous brief in front of him but he seemed to lose his nerve when using it. At heart (in spite of outward appearances) the House of Commons is always kind, but after this apprentice junior Minister had opened a sentence by proclaiming the Government to be "fully conscious" he was not taken seriously until the time came for him to sit down. But as I say, Mr. Macleod had already made the runs and, therefore, Mr. Rodgers' "duck" did not matter so much.

It may well be that I have—subject of course to the Editor's consent—another twelve months ahead of writing these notes on the present Parliament; on the other hand this may very nearly be my last contribution before we take our chances again in the great gamble of a British General Election. But whichever way the majority vote of the country goes, I believe that already the present House of Commons is a tired assembly and a new Parliament would be an advantage.

Electrical Wholesalers' Dinner

MR. PETER THORNEYCROFT ON PRESENT PROSPECTS

ABOUT 500 members and guests of the Electrical Wholesalers' Federation attended the Federation's annual dinner held at the Dorchester Hotel, London, W.1, on 19th March. The president, Mr. Harry Riley, was in the chair and the principal guest was the Rt. Hon. Peter Thorneycroft, P.C., M.P.

Mr. Thorneycroft proposed the toast of the Federation and surveyed present trading conditions at home and overseas. He thought that there were many factors favourable to wholesalers. People would never want to do without electrical equipment; expansion of distribution continued and the most prosperous countries were those with the most distribution; and wholesalers did not stand in danger of being taken over by the State. The country's economy was better than it had ever been since the war.

During his recent travels in many countries he had been struck by the fierceness of the competition of Asia, the United States, Germany and the Soviet bloc. The overriding lesson was that unless we were fully competitive in manufacturing and distributing we would go under. Some other countries could afford marginal inefficiency but we, with our smaller home market and dependence on exports, could not. However, he was convinced that the greater part of British industry was efficient.

Mr. Thorneycroft acknowledged that he had been largely responsible for drafting the Restrictive Trade Practices Act and bringing it into effect. He maintained that it would result in greater efficiency. The ending of the Yarn Spinners' Agreement would ensure that competition was based on the most efficient Lancashire producers. In any competitive sphere some concerns went to the wall while others grew bigger; big business was not necessarily bad business. We had to match the best that could be produced in any part of the world.

The principles embodied in the Act would remain part and parcel of our national policy. He thought that the need to justify restrictive practices could well be extended to the field of labour; it might make a substantial contribution to our ability to compete overseas.

Mr. Thorneycroft said that he viewed with grave anxiety the deadlock in the negotiations with the Common Market countries, largely because of possible political repercussions. There was now little time to reach agreement, for positions were being taken up and it would be difficult to alter the situation. A new approach, in consultation with the other members of the Commonwealth, was necessary, before separate arrangements were made with the Common Market countries.

Mr. Riley, responding to the toast, referred to Mr. Thorneycroft's work as Chancellor of the Exchequer and President of the Board of Trade and mentioned that he had recently joined the board of one of the large cable makers. As President of the Board of Trade, Mr. Thorneycroft was really a wholesaler on a grand scale.

Left to right: Mr. Peter Thorneycroft proposes the toast of the Federation; on his right is the director and secretary of the E.W.F., Mr. P. B. Etheridge. The president, Mr. Harry Riley, replies to the Federation toast. Mr. F. J. Blackwell (vice-president) proposes the health of the guests; Mr. Leslie Gamage is on his left. Mr. J. S. A. Bunting replies for the guests

He had the task of directing and guiding buying and selling policy, which was what wholesalers had to do.

When he (Mr. Riley) was president in 1949 they were all wondering what the results of nationalisation of the electricity supply industry would be. There was then a possibility of the nationalisation of distribution but theories in this direction had been overcome by the harsh voice of experience. Although he agreed that the national standard of living was higher than it was ten years ago, wholesalers found it more difficult to attain that standard of living and still serve their customers efficiently. It was thought that the way to avoid increases in prices to the public was to chisel away the wholesalers' normal profit margin. Another matter was the giving of extended discounts to groups whose total purchases were very small in comparison with those of the wholesalers.

During his visits to the sections of the Federation he had attempted to explain how wholesalers might keep in step with today's economic conditions. He had met with the criticism that recognition was given to far too many wholesale outlets, many of which did not even approach the standards laid down by the Federation.

Mr. Riley mentioned that a decision had been made, due in some part to the Act, that the Rubber and Thermoplastics Cable Makers' Association would shortly cease to operate. The E.W.F. viewed this with extreme regret and trusted that the members of the Association would deal with them with due consideration.

One of the things which he hoped the next ten years would bring was the repeal of the Restrictive Trade Practices Act, for he was sure that normal competitive conditions at home and abroad would accomplish all that the Act set out to do.

Mr. F. J. Blackwell (vice-president), who took over the presidency on the following day, proposed the health of the guests and referred particularly to Mr. J. S. A. Bunting, Mr. Leslie Gamage, Mr. R. F. van Heusden (president of the Dutch Federation of Electrical Wholesalers) and Dr. T. E. Allibone (president, E.I.B.A.). The response was by Mr. J. S. A. Bunting in a brief and amusing speech.

There followed an entertainment by Margo Henderson and the Voltaires.

Metrovick Linear Accelerator for Germany

THE City of Hamburg has ordered a 400 MeV electron linear accelerator from the Metropolitan-Vickers Electrical Co., Ltd., for Deutsches Elektronen-Synchrotron (D.E.S.Y.) Research Group. This order, which is worth about £250,000, has been secured in face of world competition.

The accelerator will be used to inject a beam of 40 MeV electrons into a large electron synchrotron which will then further accelerate the electrons to an energy of 6,000 MeV. To make this further acceleration possible, very rigorous restrictions are necessary on the output of the linear accelerator used for injection. Thus, very little variation is permissible on the specified 40 MeV energy, and the electron beam must be compact, i.e. small in diameter, and must have very little divergence.

The linear accelerator, which is of the travelling wave type, will be energised by short wavelength radio-frequency power, and the electrons will be accelerated along a specially shaped waveguide.

The equipment has an overall length of approximately 35ft, and comprises five sections of accelerating waveguide, each 1½ metres long, together with an electron gun and pre-buncher at the injector end. Each accelerator section will be fed by a high power klystron, also manufactured by Metropolitan-Vickers. In addition, a considerable amount of associated equipment including the klystron power supply together with controls and other services is included in the contract.

The output of the accelerator at 40 MeV is in the form of short pulses of current of 2 microseconds duration, repeating 50 times per second. Each pulse of current must supply 125 mA within the strict limit of energy and beam geometry imposed by the acceptance requirements of the synchrotron.

This accelerator, with its high energy and stringent beam requirements, adds to the range of accelerators already manufactured by Metropolitan-Vickers for industrial radiation, research purposes, and medical use in treatment centres at home and abroad.

LETTER TO THE EDITOR

Letters should bear the writers' names and addresses, not neccessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Protest Against I.T.V. Programme

I LOOKED in at the I.T.V. "Searchlight" programme on 16th March and was infuriated by the implications against traders like myself. I consider it a personal affront and have demanded of the Independent Television Authority the right to reply in person at the earliest possible time.

In my opinion the method of presentation of the facts was a complete distortion of the true picture. This irresponsibility must cause distress to many traders like myself, none of whom was present to defend or debate the problem presented.

Somebody must have had some qualms as to the propriety of dealing with this subject in this manner and I feel that the entire procedure should be overhauled to provide adequate safeguards either by having somebody present at the time to discuss the accusations, or an immediate further programme to reply.

I seek most earnestly to defend the repairers in my trade who have been so maligned.

London, W.2.

JOHN HOLDER,
Director,
Cunningham, Ltd.

[The programme to which Mr. Holder refers related to the execution and cost of repairs to electrical appliances, radio and television equipment and motor cars. It was commented on by "Reflector" in last week's issue.—Editors, *Electrical Review*.]

Shawinigan Expansion

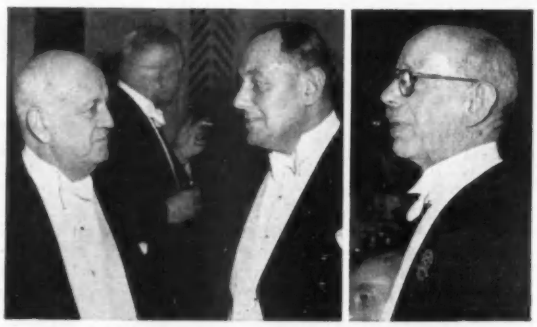
The projected establishment of several large iron and steel industries along the south shore of the St. Lawrence is referred to by Mr. J. A. Fuller, president of the Shawinigan Water & Power Company, in his report for 1958, as one of the factors likely to lead to a rise in demand for power. Last year the company sold 10,973 million kWh, an increase of 6·4 per cent. A number of large industrial customers reduced their purchases of primary power, but sales to residential, farm, commercial and small industrial customers rose 9·9 per cent. Residential customers increased their total purchases by 14·5 per cent and farm customers by 16·6 per cent.

1. *Mr. H. H. Spencer (president) and Mrs. Spencer.* 2. *The president makes a presentation to Mr. T. C. F. Bigland (the "Mate").* 3. *Mr. J. W. Perkins proposes "Sweethearts and Wives."* 4. *Sir Harold Bishop, Mr. W. N. C. Clinch and Mr. E. A. Mills with their ladies.* 5. *Mr. W. S. Steel and Mr. S. B. Warder with their ladies*

Batti-Wallahs' Ladies' Night

THE ladies' night of the Batti-Wallahs' Society is one of the major electrical social functions of the season and this was evidenced by the large gathering of members and friends, with their ladies, at the Connaught Rooms, London, on Friday last week. Many prominent men from all branches of the electrical industry were present. The guests were received by Mr. H. H. Spencer, the president, and Mrs. Spencer.

As is customary, the speeches were brief, the two toasts being to the president and to the ladies. Mr. Forbes Jackson, in a felicitous and witty speech, proposed the toast to the president and briefly outlined his career from his early days as an apprentice with Crompton & Co., to his present position as director and general manager of Rustyfa, Ltd., the consortium of British companies which is supplying equipment for a large Russian tyre factory.



Mr. R. H. Gummer (left) and Mr. L. Drucquer. Right: Mr. Forbes Jackson proposes the toast to the president

Mr. Spencer, in reply, expressed the regret of all present at the absence of Dr. L. G. Brazier (immediate past-president) who was making a good recovery from his illness, and said that a message was being sent to him on behalf of the members wishing him a speedy return to normal health. He referred to the gathering as a family party and was sorry that they had had to restrict the numbers. He spoke of his happy year of office and he thanked the committee for the support which it had given him.

Mr. Spencer's speech was followed by a "surprise item," when he presented Mr. T. C. F. Bigland (the "Mate") with a shooting stick on behalf of himself and past-presidents of the Society, and in making the presentation he spoke appreciatively of the valuable work which Mr. Bigland had done as hon. secretary of the Society.

The time-honoured toast of "Sweethearts and Wives" was gracefully given by Mr. J. W. Perkins (a past-president), who was in excellent form, and Mrs. Spencer, replying on behalf of the ladies, thanked the Society for giving them such an enjoyable evening.

Dancing followed the dinner and during the evening Clifford Stanton entertained the company with his "Personalities on Parade."

"Nescoe" Reunion

On 19th March the 1959 reunion dinner of the N.E.S.C.O.E. Association was held in Newcastle under the chairmanship of the president, Lt.-Col. E. H. E. Woodward, C.B.E., M.C., T.D., B.Sc.(Eng.), M.I.E.E. The Association is composed of members of the former North-Eastern Supply Companies' old employees and consultants and advisers of those companies. In connection with the reunion the directors of C. A. Parsons & Co., Ltd., and A. Reyrolle & Co., Ltd., arranged for members of the Association to inspect their works and research establishments on Tyneside during the morning of 20th March, and afterwards they entertained the visitors to lunch.

OVERSEAS ELECTRICAL TRADE

Lower Exports and Imports in February

THE seasonal fall last month in Britain's total overseas trade, with, as usual, a bigger drop in imports than in exports, brought the visible trade deficit down to £31·1 million, £18 million less than in January. Electrical exports amounted to £17·7 million in February, £1·2 million less than in January. In January and February together they were 4 per cent less than in the corresponding period of 1958.

Electrical imports in February were £2·6 million, compared with £2·8 million in January. In the two months January and February they were £0·8 million more than in the corresponding period of 1958.

Shipments to the United States at £712,907 were £250,000 less than in January, and shipments to Canada at £683,939 were £150,000 less.

The drop in exports was reflected in all the main product groups except telegraph and telephone apparatus, which amounted to £1·9 million last month compared

TABLE I.—ELECTRICAL EXPORTS

Class	Month of Feb., 1959	Two months ended 28th Feb., 1958	Two months ended 28th Feb., 1959
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	91,768	258,608	202,441
Ditto, 10 to 65 kW	199,293	354,223	331,926
Ditto, 65 to 200 kW	77,580	398,963	232,112
Ditto, over 200 kW	240,065	547,420	476,914
Spark ignition engine driven	7,967	31,388	24,999
Steam turbine driven	258,668	121,851	271,782
Hydraulic turbine driven	—	—	—
Other prime mover driven	28,641	29,708	82,273
Generators, not exceeding 200 kW	94,694	358,707	223,136
Ditto, over 200 kW	77,836	218,090	227,436
Parts of generators	385,211	1,189,573	1,071,019
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ½ h.p.	139,989	275,371	268,787
Over ½ but under 1 h.p.	42,677	135,590	92,821
1 h.p. to 250 h.p.	461,939	1,019,227	884,808
Over 250 h.p.	156,610	197,015	319,726
Railway, tramway and trolley-bus motors complete and parts of all motors	210,379	538,854	386,035
Motor starting and controlling gear	411,279	536,803	734,345
	2,884,596	6,211,391	5,830,560
Converting machinery	9,932	82,078	58,837
Mercury-arc rectifiers	54,947	206,522	109,828
Transformers for lighting, heating and power (incl. coils):			
Not exceeding 7,500 kVA	566,937	1,424,310	1,127,267
Over 7,500 kVA	485,647	707,851	881,116
Switchgear and switchboards (not telegraph or telephone), up to 200 A and 660 V	268,654	972,314	674,783
Ditto, other	1,068,831	1,923,881	2,356,059
	2,454,948	5,316,956	5,207,890
Primary batteries:			
Lighting	101,414	188,106	221,866
Radio	283,838	558,268	657,030
Other	33,523	96,798	83,027
Parts (excl. carbons)	32,495	101,385	80,690
Lamps:			
Filament, exceeding 28 V	75,243	176,969	166,082
Ditto, under 28 V	32,994	57,308	70,282
Arc lamps and searchlights	12,273	37,362	28,884
Discharge lamps, fluorescent tubes, etc.	93,819	181,298	193,032
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury-arc rectifiers), photo-electric cells, stabilising and cold cathode valves, magnetrons, klystrons	33,965	47,615	65,731
All other*	537,336	809,234	1,097,080
Parts (excluding glass bulbs)	16,829	30,320	48,932
Radio and television transmitters	62,970	78,884	68,786
Commercial radio and radar equipment	1,414,172	2,345,923	3,029,272
Domestic radio receivers, mains	76,803	167,667	183,670
Ditto, battery	53,630	108,586	123,115
Ditto, other (incl. car)	31,725	60,413	52,679
Radiograms	22,162	83,254	62,420
Television sets	79,829	220,327	133,349
Public address equipment	92,408	211,135	204,890
Other radio and television apparatus, n.e.s.	46,231	49,731	72,975
Components and parts, n.e.s.	701,252	1,550,430	1,484,622
	3,169,312	5,763,519	6,628,521
Telegraph and telephone installations	810,713	1,921,297	1,433,231
Telephone instruments, separately consigned	84,088	477,246	170,937
Telegraph and telephone parts	796,565	1,539,470	1,696,302
Line apparatus for long distance communication	304,210	354,319	399,645
	1,995,576	4,292,332	3,700,115

Class	Month of Feb., 1959	Two months ended 28th Feb., 1958	Two months ended 28th Feb., 1959
	£	£	£
Cookers	29,525	107,294	77,715
Toasters	17,481	44,877	38,160
Other cooking apparatus	34,797	70,546	75,176
Parts and accessories	81,915	124,417	145,876
Space heating appliances	21,942	76,079	39,858
Water heating appliances	29,608	46,377	59,335
Other heating appliances	25,864	86,351	55,038
Parts and accessories	70,917	111,317	137,221
Irons	54,857	183,093	127,815
Arc welding equipment, a.c.	26,437	173,154	66,944
Ditto, d.c.	62,298	54,587	104,206
Resistance welding equipment	22,277	28,528	36,900
Electric furnace plant	99,984	143,730	136,498
Magnetos, ignition	6,454	33,656	20,317
Sparking plugs	138,314	301,250	294,698
Elec. appliances for aeroplanes, n.e.s.	298,441	530,484	613,900
Ditto, for motor vehicles, n.e.s.	350,976	739,539	773,403
Ditto, for cycles, n.e.s.	38,713	108,836	72,488
Signalling app. (incl. traffic signals)	180,326	355,039	352,184
Instruments, commercial	144,749	349,653	328,152
House service meters (including parts)	108,580	331,181	233,153
Electro-medical apparatus (not X-ray)	29,746	75,498	58,917
X-ray apparatus (excl. tubes and valves)	33,101	100,406	79,262
Ceiling fans, complete	67,510	174,337	150,830
Desk fans, complete and parts of desk and ceiling fans	11,226	62,098	27,201
Vacuum cleaners	137,988	275,659	254,408
Floor polishers	57,168	150,833	138,299
Food mixers	78,774	99,870	137,858
Hair clippers and dry shavers	11,178	125,584	85,171
Other portable appliances	13,713	48,361	36,990
Parts	104,435	289,098	190,545
Portable elec. tools (not saws) and parts	180,450	473,081	387,716
Cables and wires:			
Telegraph and telephone, submarine	20,569	126,610	38,278
Ditto, other	450,602	1,467,833	871,435
Cotton, silk or art. silk insulated	23,784	81,176	55,873
Enamel, glass or asbestos insulated	101,229	154,397	185,535
Paper insulated	584,253	1,055,091	1,181,473
Rubber insulated	265,077	1,130,625	566,504
Thermoplastic insulated	232,954	446,089	419,859
Other	153,812	522,215	364,709
	1,832,280	4,984,036	3,683,666
Accumulators for motor vehicles	166,162	247,060	252,157
Ditto, traction	20,016	44,092	39,929
Ditto, radio and other portable	22,456	110,286	47,071
Ditto, other	67,136	52,306	165,541
Parts and accessories	62,507	220,978	150,774
Electric wiring accessories	177,233	223,575	358,221
Elec. ceramic ware, etc. (incl. insulators), n.e.s.	108,872	206,008	234,626
Insulating cloth and tape	37,824	98,151	89,675
Other insulating material	112,871	187,005	210,578
Permanent magnets	43,600	101,619	95,492
Radio, telegraph and telephone testing equip., n.e.s.	131,886	107,408	262,998
Scientific elec. instruments (excl. telegraphic or telephonic, time recorders and time switches)	254,218	640,018	580,997
Electrical machinery, n.e.s.	72,651	154,503	109,149
Electrical apparatus and appliances, n.e.s.	922,436	1,829,805	2,095,955
TOTAL	17,721,923	38,063,355	36,581,032

* The figures for 1959 are not strictly comparable with those for 1958.

TABLE 2.—DISTRIBUTION OF EXPORTS (TABLE 1)

Country	Month of Feb., 1959	Two months ended 28th Feb., 1958	Two months ended 28th Feb., 1959
	£	£	£
Gibraltar	10,587	98,473	22,786
Malta and Gozo	29,138	131,329	79,539
Cyprus	57,739	204,104	139,159
Sierra Leone	29,006	118,355	59,016
Ghana	166,795	317,859	365,708
Nigeria	508,363	608,980	935,731
Union of South Africa	1,575,847	3,434,396	2,903,238
Rhodesia and Nyasaland	503,100	998,712	993,315
Tanganyika	28,384	99,063	81,996
Kenya	103,128	301,427	271,944
Uganda	22,217	149,916	76,261
Mauritius	32,053	42,900	84,447
Aden	48,318	119,413	140,723
Bahrain, Qatar and Trucial States	98,161	165,631	176,902
Kuwait	217,014	333,924	410,430
India	1,542,872	3,155,585	3,093,208
Pakistan	358,141	603,546	582,610
Singapore	276,506	635,674	561,719
Federation of Malaya	289,382	612,470	605,128
Ceylon	169,297	247,768	418,146
British North Borneo	9,517	50,803	33,383
Sarawak	4,990	27,849	20,477
Hong Kong	339,030	593,948	730,764
Australia	1,302,711	3,529,756	2,734,748
New Zealand	876,813	2,703,974	1,730,518
Fiji	30,748	71,159	82,653
Canada	683,939	1,750,569	1,515,696
Jamaica	119,891	288,668	260,655
Barbados	21,576	56,472	76,123
Trinidad	125,997	238,917	226,920
British Guiana	153,661	72,047	228,842
Other Commonwealth countries	229,491	385,187	401,875
Irish Republic	296,829	531,183	624,165
Soviet Union	198,121	58,969	211,995
Finland	86,615	349,172	190,884
Sweden	577,294	864,715	1,038,892
Norway	203,211	447,746	413,966
Denmark	180,889	370,376	429,238
Poland	19,038	189,326	100,718
Western Germany	476,422	414, 57	760,063
Netherlands	615,077	1,254,629	1,396,941
Belgium	217,845	604,120	831,591
France	253,756	721,691	595,363
Switzerland	133,069	257,862	290,874
Portugal	237,347	948,603	389,993
Spain	98,135	386,817	474,0 4
Italy	250,482	598,150	539,051
Austria	47,294	85,422	88,985
Yugoslavia	82,145	97,243	150,188
Greece	98,290	237,666	211,160
Turkey	52,555	157,065	63,115
Belgian Congo	47,819	72,200	90,113
Portuguese East Africa	11,905	36,094	32,920
Egypt	356,260	140,778	536,112
Libya	100,718	105,364	213,066
Morocco (excluding Tangier)	54,860	60,906	104,245
Sudan	61,679	182,386	195,028
Syria	18,094	44,384	37,383
Lebanon	47,786	152,078	95,559
Israel	56,967	168,238	167,484
Jordan	38,655	154,950	108,756
Saudi Arabia	57,512	184,641	123,804
Iraq	238,871	647,379	726,556
Iran	391,619	729,823	685,210
Burma	198,089	162,086	257,085
Thailand	60,887	406,741	159,361
Indonesia	4,899	70,174	18,800
Japan	63,847	91,712	114,507
United States of America	712,907	1,141,686	1,682,470
Cuba	54,001	196,480	95,835
Mexico	32,255	117,525	83,143
Colombia	35,825	106,429	67,686
Venezuela	312,564	913,575	735,432
Peru	13,360	75,472	43,326
Chile	127,967	65,145	260,084
Brazil	34,474	261,673	100,296
Uruguay	1,810	10,840	25,622
Argentine Republic	37,682	458,036	192,656
Other foreign countries	459,785	582,774	782,637
TOTAL	17,721,923	38,063,355	36,581,032

TABLE 3.—SOURCES OF ELECTRICAL IMPORTS

Country	Month of Feb., 1959	Two months ended 28th Feb., 1958	Two months ended 28th Feb., 1959
	£	£	£
Australia	43,163	99,851	94,262
Canada	90,805	166,820	141,390
Other Commonwealth countries	91,679	226,324	198,386
Irish Republic	98,116	138,827	171,228
Sweden	79,400	166,275	205,824
Denmark	56,447	102,895	94,540
Western Germany	484,653	851,799	1,010,107
Netherlands	439,809	702,810	923,633
Belgium	39,831	115,628	99,272
France	99,563	225,402	229,209
Switzerland	103,954	231,284	196,598
Italy	66,771	107,016	156,495
United States of America	740,405	1,196,202	1,607,122
Other foreign countries	139,861	203,641	245,988
TOTAL	2,574,457	4,534,774	5,374,054

with £1·7 million in January. There was a small increase in the exports of the smaller sizes of washing machines, in cooker parts and space heating appliances. Exports of electric and diesel electric locomotives were also higher than in January.

The leading market for generating sets and motors in February was India to which plant worth £462,200 was shipped. Next in order of importance were South Africa (£284,859), Australia (£220,717), the United States (£192,236), Canada (£180,518) and Burma (£158,835). Converting machinery, transformers and rectifiers were sent principally to India (£419,614), South Africa (£347,055), Australia (£290,669) and Rhodesia and Nyasaland (£227,485).

The Netherlands (£299,014) was the largest market for radio and electronic apparatus, followed by Western Germany (£234,013), Pakistan (£212,662) and Sweden (£206,998). The largest shipments of telegraph and telephone apparatus were again made to South Africa (£241,323), New Zealand (£228,278), Australia (£205,361) and Hong Kong (£120,226).

Exports of wires and cables, which were only slightly below the January total, included large shipments to India (£225,852), New Zealand (£115,468) and Hong Kong (£94,942).

Details of electrical imports are given in Table 5, with the principal countries from which they came in Table 3. Table 2 shows the destinations of the exports detailed in Table 1, and Table 4 lists electrical goods included in other sections of the returns.

TABLE 4.—OTHER ELECTRICAL EXPORTS

Class	Month of Feb., 1959	Two months ended 28th Feb., 1958	Two months ended 28th Feb., 1959
	£	£	£
Washing machines, electrically operated:			
Not exceeding 150 lb weight	247,637	687,014	485,871
150 lb to 250 lb	42,025	136,181	85,708
Parts	85,9 8	125,458	178,991
Electric locomotives (incl. battery types)	471,930	534,043	940,070
Diesel locomotives with electrical transmission	104,068	321,838	141,173
Welding electrodes:			
Ferrous	64,225	190,656	134,132
Non-ferrous	17,599	56,792	41,591
Electric conduit tubes and cased tubes	63,052	107,343	121,109
Electric carbons	72,055	103,047	171,242
Electric lighting fittings and lanterns (excl. arc lamps, searchlights and cycle lamps)	244,845	767,776	539,698
Electric fork-lift trucks	87,017	129,409	172,206

TABLE 5.—ELECTRICAL IMPORTS

Class	Month of Feb., 1959	Two months ended 28th Feb., 1958	Two months ended 28th Feb., 1959
	£	£	£
Generators, incl. parts	77,328	105,607	153,298
Motors, incl. parts	102,172	185,732	207,449
Convertors; transformers; rectifiers*	55,315	41,483	149,327
Switchgear and switchboards (not telegraph and telephone)	67,444	89,549	151,311
Cathode ray tubes, complete	96,134	158,389	150,081
Other valves, complete*	221,806	350,032	439,026
Parts (excl. glass bulbs)*	57,462	92,496	118,653
Radio receiving sets, domestic or portable	7,858	35,639	23,287
Radio communication and navigational aids, complete	322,961	624,587	697,286
Other radio and TV apparatus, parts and accessories	248,246	670,939	678,563
Apparatus for telegraphy and telephony*	86,343	91,335	151,581
Welding machinery	33,822	39,493	60,389
Cooking and heating apparatus	125,144	239,185	255,728
Magnetos, ignition, and electric appliances for aeroplanes, motor vehicles and cycles	125,056	386,303	299,513
Electro-medical apparatus (incl. X-ray apparatus)	94,854	137,050	144,263
Portable mechanical appliances, electrically operated, complete	73,328	133,119	220,15
Parts	47,009	111,120	95,98
Scientific electrical instruments (excl. telegraphic and telephonic)	118,501	254,808	246,24
Other machinery, apparatus and appliances	613,674	787,908	1,131,92
TOTAL	2,574,457	4,534,774	5,374,05

* The figures for 1959 are not completely comparable with those for 1958.

VIEWS on the NEWS

By REFLECTOR

NEW power stations, although execrated by amenity organisations, are generally welcomed locally because of the employment they create. There is also another reason for local rejoicing when the Central Electricity Generating Board announces its intention of putting a power station in the district—it means a substantial contribution to the rates. For instance, the Castle Donington Rural Council recently announced that it was able to reduce its rate by 2s in the £ because the new power station in its area had added £106,000 to the rateable value of the area.

* * *

Choosing the right moment at which the direction of the affairs of a company should be handed over to a younger man is a difficult problem that does not lend itself to generalisation. If the normal retiring age is rigidly adhered to, valuable skills and judgment that can only be acquired from years of practical experience may be lost at a time when they are most needed. Nevertheless, the rapid expansion of the electrical industry, and the rate at which new techniques are being developed, puts a greater premium on the more youthful attributes of energy, adapability and adventurousness than is the case in many other fields. It augurs well for the future of the industry that the progressive changes that have been taking place in the leadership of individual firms should also be reflected in the composition of the B.E.A.M.A. Council. According to Mr. J. O. Knowles, who himself last week was succeeded as chairman by a younger man, a third of the members joined the Council during 1958 and half have served for less than three years.

* * *

Southern Electricity reproduces the following letter said to have been received from a consumer in the Yeovil District:—

"I am sorry to think we have had to have a reminder of our account, we are most grateful to have had the job done for us, and are sorry for the delay in payment, so far here it has been all outlay, we have your money in stock as we have specially kept three pigs to go to the butcher to pay this bill but my husband says they really want another couple of weeks. Do you think you could give us that much grace?"

This letter suggests that it might be fun to receive payment in kind.

* * *

The *Sunday Mail* (Glasgow) recently reported that Dean of Guild Robert Callaghan, of Kilsythe, Stirlingshire, was "shocked" when he heard at a town council meeting that it was proposed to install electric floor warming in sixteen council houses. He said he had just come from a meeting of miners "protesting at redundancy"; he asked what was wrong with using coal. One councillor, however, was quite happy about electric floor heating. He was a miner and most of the sixteen houses will be tenanted by miners. He said that they had been to see some houses in Kirkcaldy with this form of heating and a miner's wife said she would never want to go back to coal fires. I cannot see what all the fuss is about; the county is in the South of Scotland Board's area and so is presumably supplied with coal-produced electricity.

* * *

In a special article the New York *Electrical World* compares the operations and results of the former Central Electricity Authority with American "Class A and B private utilities." It is contrived to show that in almost every respect the British nationalised system does not come up to the American companies. The purpose is, of course, to demonstrate the superiority of private enterprise. I can leave the Central Electricity Generating Board to answer on behalf of its predecessor but there is one thing I have noticed. The *Electrical World* says that "C.E.A. must be commended for its realistic depreciation policy and for its realistic pricing, however unpalatable that may be to the customers." There are, of course, people in this country who contend that the depreciation allowances are quite inadequate and that the consumers are undercharged. In fact three weeks earlier the same journal (unfairly judging the C.E.A.'s position from incomplete accounts—the first nine months of the year 1957-58) after mentioning interest and depreciation and a "consolidated deficit" of $7·5 million said:—

"From this we can only conclude that the operation is in quite a shaky position. We might suggest that our good neighbours consider a rate increase this year. Then they might balance the books, pay the growing rate of interest, and perhaps supply a little tax money for the treasury."

In point of fact although there was an adverse balance of £7·5 million (not 7·5 million dollars) for the nine months, for the whole year there was a surplus of over £16 million.

* * *

The following note on an early experiment in the transmission of signals without wires appeared in the *Electrical Review* of 31st March, 1899:—

"Zickler some time ago succeeded in transmitting signals over a distance of two or three hundred yards by taking advantage of the property of ultra-violet light which facilitates a spark discharge over an air gap. Dussaud has now succeeded in transmitting sounds and even words by the ultra-violet rays. The rays are made to act by means of a fluorescent screen on a plate of selenium, and the vibrating membrane of the transmitter is so arranged that while vibrating it cuts off varying amounts of the rays. The action on the selenium and the current which flows through it varies, just as it varies in an ordinary telephone. An ordinary telephone is used as a receiver in Dussaud's apparatus; but the distance over which messages have been transmitted is only a few yards."

Electrical Engineers' Exhibition

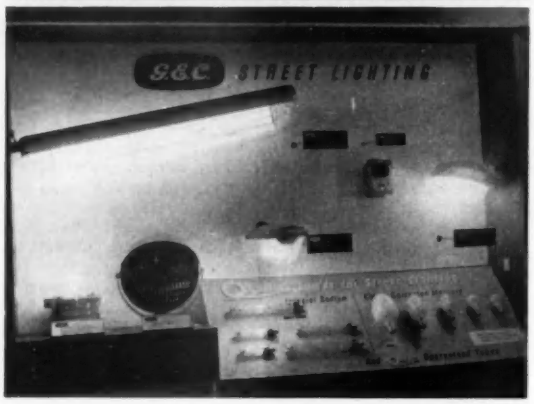
SURVEY OF THE EARLS COURT DISPLAY

THIS year's display at the Electrical Engineers' Exhibition at Earls Court was the brighest so far in the series and the high standard of stand design and arrangement set during the last few years was very well maintained, if not surpassed, by most exhibitors. There was great variety in appearance, which with generous but tasteful use of lighting and colour created a very pleasing overall effect. In previous years the actual layout of the exhibition could have been improved and the signposting was poor. This year, however, it did seem easier to find one's way about, but it is a great pity that the main doors should open up to a confusing number of small stands. Surely a more striking arrangement could have been adopted.

During the past few years a definite pattern seems to have been set for the display and once again lighting fittings, switchgear and electrical accessories appeared to predominate. For obvious reasons the accent of the show was on selling and this, no doubt, accounted for the fact that there was very little equipment to be seen which was completely new. A good many of the items on view were improved versions of well-established designs to meet the requirements of customers in all parts of the world. One cannot visit the exhibition without being impressed with the ingenuity and competence of British electrical engineers. It is not surprising that the electrical industry is the biggest exporting industry in the United Kingdom.

In a survey of this nature it is obviously not possible to mention all of the interesting items displayed, particularly in view of the magnitude of the show. Rather than attempt to cram a quart into a pint pot we are mentioning only a few of the more striking exhibits which took our eye on walking round the exhibition hall.

Top: Thorpe glassfibre lighting reflector. Below: Street and airport lighting fittings displayed on the G.E.C. stand



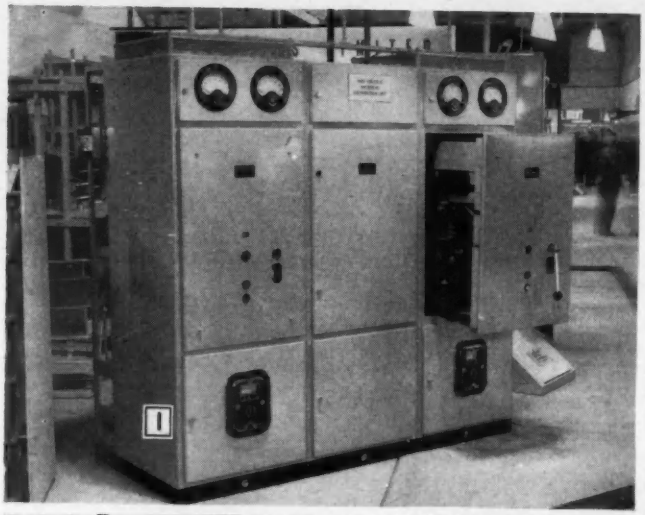
Since 1959 is the golden jubilee year of the Illuminating Engineering Society, it was appropriate that there was an emphasis on lighting and many special features devoted to illumination were arranged. For instance, there was a spectacular "night sky" setting in the entrance foyer in which 64 fluorescent tubes reflected against a glittering ceiling pattern. The corridors leading into the exhibition included an avenue of light; 40ft of tungsten spotlighting was recessed behind the newly-developed Siemens-Ediswan "Celotex" illuminated acoustic ceiling. Another striking exhibit was a huge crystalline plastic hand mounted on a 20ft high framework straddling the main gangway on the ground floor. This hand was a stylised representation of the symbol adopted by the I.E.S. for its jubilee celebrations. The hand was 18ft high and contained 120 coloured lamps worked by an automatic colour change system. Between the forefinger and thumb the hand held a golden ball illuminated by 16 lamps.

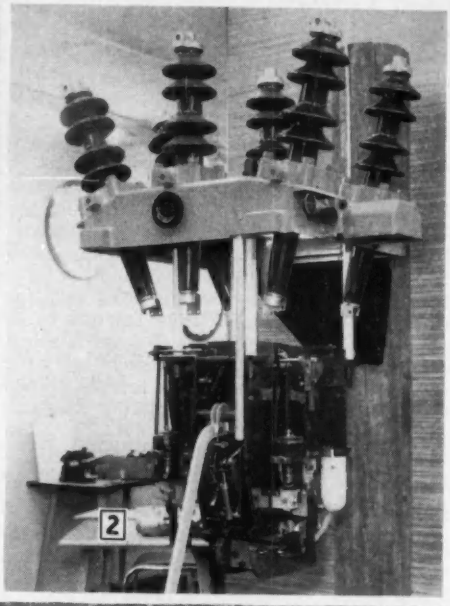
In a section of the exhibition on the first floor was a series of ten shop windows whose illumination had been designed by the country's leading specialists and the windows dressed by well-known companies. This part of the Earls Court display was prepared by the exhibition organisers in support of the shop window lighting campaign of the British Lighting Council. The windows were arranged to form an arcade of the type which might well be used in the new towns now springing up in various parts of the country. The products which were shown included textiles, glassware, books and stationery, furniture, carpets and rugs. The lighting fittings firms who presented windows were the A.E.I. Lamp & Lighting Co., Ltd.; Atlas Lighting, Ltd.; Courtney Pope (Electrical), Ltd.; Crompton Parkinson, Ltd.; Falk, Stadelmann & Co., Ltd.; the General Electric Co., Ltd.; Harris & Sheldon (Electrical), Ltd.; Rowlands Electrical Accessories, Ltd.; Siemens Edison Swan, Ltd.; and Troughton & Young, Ltd.

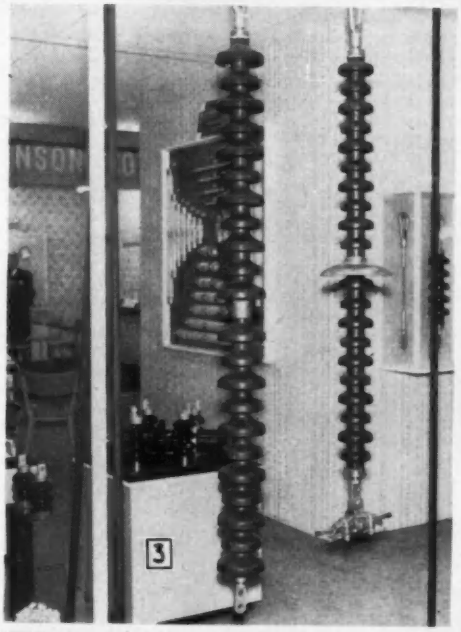
Lighting

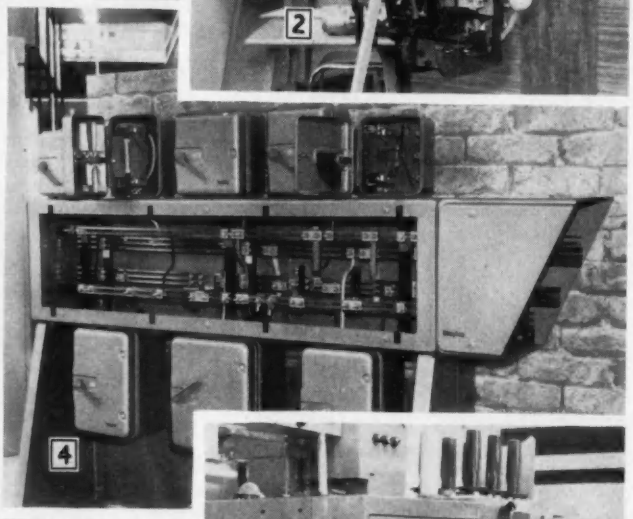
In addition to the illumination features already described, many exhibitors arranged special displays of both lighting equipment and lighting effects. Attention was drawn to the Atlas Lighting, Ltd., stand by a large revolving tower of lighting fittings, and this company presented a new form of entertainment, "Aurama," in which modern lighting, stereophonic sound and electronic control were combined. The music was recorded by E.M.I., Ltd., on twin-track tape, and reproduced by Stagesound (London), Ltd. Signals superimposed on the sound track determined the 110 lighting changes during the 14 min performance.

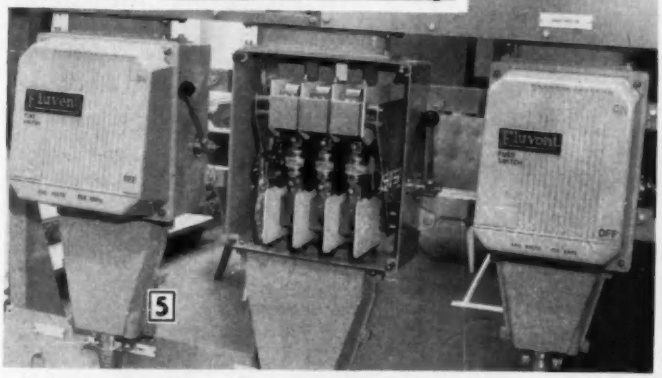
Visitors to the Philips Electrical, Ltd., stand passed through corridors in which various displays were given. These included infra-red radiant heating, the fluorescent effect of ultra-violet light on many materials, and electroluminescence. The last-named uses panels of a material, effectively a capacitor, in which the loss takes the form of light emission from a phosphor. The panels can be connected to the a.c. mains without a ballast, and their











1. D.c. switchgear shown by Bertram Thomas. 2. Reyrolle type OYT auto-reclose pole-mounted circuit-breaker. This was a demonstration unit. The mechanism is normally attached directly below the tank. 3. "Dimex" insulators on the Electric Transmission stand. 4. A range of "Star" switchgear shown by Simplex Electric. 5. Part of a range of heavy duty "Fluvent" fuse-switchgear shown by Parmiter, Hope & Sugden. The opened unit has a rating of 400 A. 6. Ferguson Pailin type BPV17 oil circuit-breaker unit with integral earthing

efficiency is optimum at mains voltages and at frequencies below 1,000 c/s.

Fittings giving a high illumination level, of the order of 100 lumens/sq ft, without glare, were shown by the General Electric Co., Ltd. Tubular fluorescent lamps are used with aluminium trough reflectors and stepped louvres. In the street lighting section two new lanterns were shown, with an airport floodlight and aircraft obstruction neon warning light.

A large number of new fittings were introduced at the exhibition, among them being the complete "Model Fifty" range of reflectors for tungsten, mercury and fluorescent lamps up to 1,500 W announced by Benjamin Electric, Ltd., and a corrosion-proof reflector for one or two 80 W fluorescent lamps made in moulded glass fibre by F. W. Thorpe, Ltd. A range of shock-resisting and waterproof fluorescent handlamps and barrel inspection lamps were displayed by the British Central Electrical Co., Ltd., and a new high bay concentrating reflector was shown by the Simplex Electric Co., Ltd., designed for use with a 1 kW mercury discharge lamp with fluorescent coating, and suitable for mounting at heights over 30ft.

Switchgear

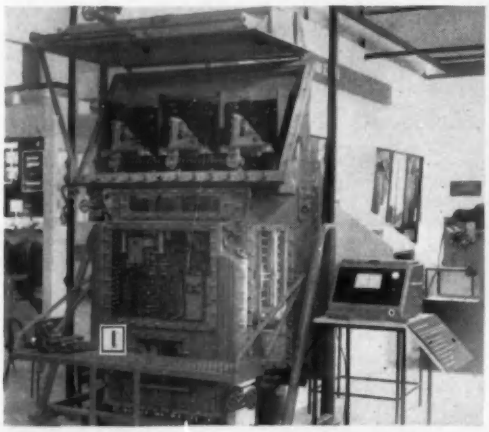
The many items of electrical apparatus which fall into the broad classification of switchgear once again formed a large proportion of the products on view. The majority of the new items shown for the first time at this year's exhibition were l.v. fusegear and miniature circuit-breakers. There was a small but definite trend towards some reduction in the size of micro-switches, miniature circuit-breakers and other miniature equipment. No doubt this was partly due to the increasing application of automatic control systems.

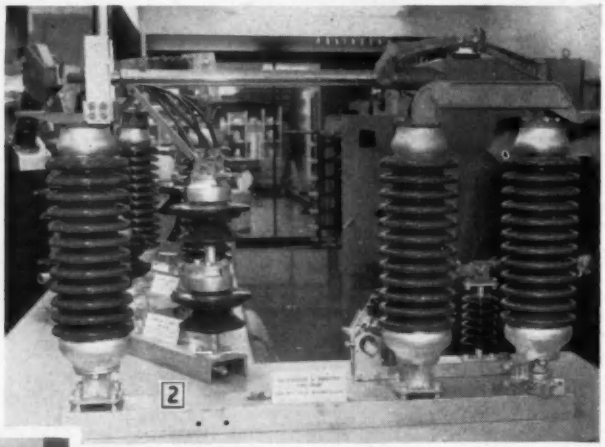
One of the smallest items of switchgear shown at the exhibition was the sub-micro-switch, type SX, exhibited by Honeywell Controls, Ltd. This switch measures 0·5in by 0·35in by 0·2in and weighs $\frac{1}{28}$ oz. It has a single-pole double-throw action and is available with plunger, roller or lever actuators. The silver contacts are rated at 5 A at 250 V a.c. and the terminals are gold plated. The switch has an average tested life of half-a-million operations.

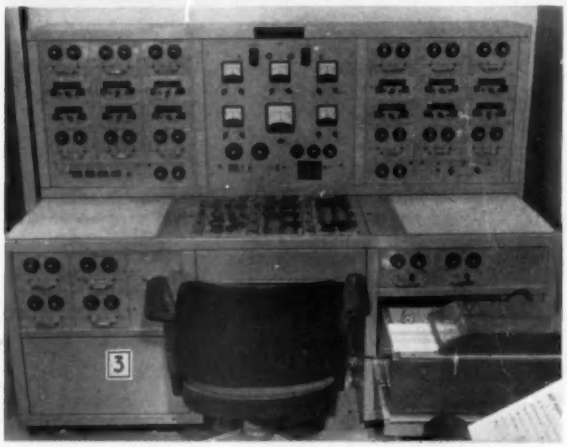
A new miniature circuit-breaker, the "Midget," based on the Lupus range of m.c.b.'s, was shown by the M.C.B. Co. (Manchester), Ltd. The arc chamber has a ribbed opening closed by a metal grid which allows ventilation and escape of gases whilst controlling the arc in the case of short circuits. It is available in standard ratings from 5 A to 50 A.

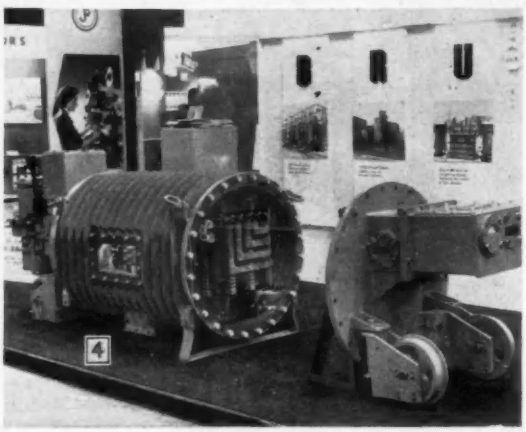
Switchfuses with front, instead of the conventional side, operation were shown by the Simplex Electric Co., Ltd. This completely new range of "Star" switchgear includes switchfuses, distribution fuseboards, busbar

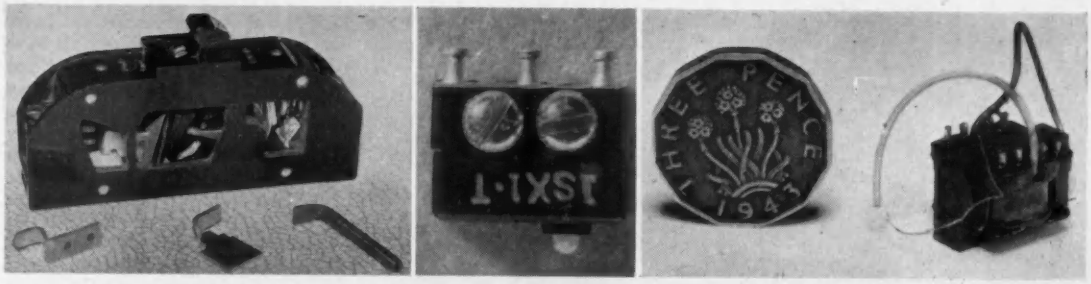
1. Ferranti type DC3 tap changer. **2.** *Selection of Hackbridge 33 kV overhead line gear showing an 800 A isolator in the foreground.*
3. *English Electric analogue for analysing servo problems.* **4.** *Brush 300 kVA mining transformer*











Left: M.C.B. Co.'s "Midget" miniature circuit-breaker. Centre: Honeywell Controls type SX sub-micro switch rated at 5 A at 250 V. Right: A 400 c/s Fraser Speller airborne transformer

chambers and switchboards. Both switchfuses and fuseboards have all live parts shrouded, even with fuses removed. The switch mechanisms, fuse base contacts and terminals are accommodated on a one-piece non-track ceramic base. The fuse switch base hinges out for easy wiring. The new "Fluvent" distribution boards shown by Parmiter, Hope & Sugden, Ltd., have front wired construction, enabling spare circuits to be cabled with live busbars.

There were no outstanding developments in the field of h.v. switchgear on show at Earls Court, although a number of new designs of indoor metalclad oil circuit-breaker units were to be seen. Their new vertically isolated, air-insulated type BPV17 11 kV switchgear was shown by Ferguson Pailin, Ltd. The units are arranged for integral earthing for both busbar and feeder circuits, the circuit-breaker truck having three horizontal positions, one for feeder earthing, one for busbar earthing and a normal service position. Positioning of the truck is pre-selected by means of a simple mechanism on the unit housing. This mechanism can be padlocked to prevent inadvertent selection of the earthing positions, whilst allowing the truck to be pushed into or out of its normal service position. George Ellison, Ltd., also showed a new air-insulated oil circuit-breaker rated at 250 MVA at 11 kV. The high-pressure contacts have a parallel wiping action to ensure long life. A new mining type flameproof air-break circuit-breaker of 400 A rating with a making and breaking capacity of 7·5 MVA at 11 kV, as required by the draft N.C.B. specification, was shown by Switchgear & Cowans, Ltd.

Over 80 per cent of the faults which occur on h.v. rural distribution systems are of a transient nature. If the system is protected by fuse-links, a fault entails a prolonged interruption of supply. High-speed circuit-breakers have been developed for use in conjunction with fuse-links to reduce the number of occasions that the fuse-links have to operate. A new high-speed automatic reclosing circuit-breaker type OYT was shown by A. Reyrolle & Co., Ltd. Designed for pole mounting, it is rated at 75 MVA at 11 kV and is spring operated, the spring being automatically charged electrically from the h.v. supply after each trip. When a fault occurs, the circuit-breaker interrupts the short-circuit current before the fuse-link can operate and it remains open for approximately one second. During this time the fault path de-ionises and in the majority of cases the fault disappears. If the fault remains, a second high-speed interruption and reclosure are made. If the fault still persists it is assumed to be a permanent one and the reclosure operation is automatically delayed to permit the fuse-link to isolate the fault. If the fault current is insufficient to blow the fuse, a second delayed opening and reclosing operation is made. If, after the fourth operation, the fuse-link has not cleared the fault, the circuit-breaker will open and lock-out.

Johnson & Phillips, Ltd., showed a new 3·3 kV, 150 MVA oil circuit-breaker incorporating cross-jet arc-control devices of improved pattern. Totally enclosed d.c. switchboards are now being produced by Bertram Thomas (Engineers), Ltd. These boards can be fitted with horizontally withdrawable semi-high-speed circuit-breakers and isolators. The circuit-breakers are rated from 0 to 1,600 A and up to 800 V.

One of the largest exhibits was the South Wales Switchgear combined 33/11 kV packaged outdoor sub-station. This substation contains a vertical isolation horizontal draw-out 33 kV oil circuit-breaker rated at 1,000 MVA together with 11 kV circuit-breakers rated at up to 350 MVA. Facilities are also available for the inclusion of a built-in control room, tripping units and auxiliary supplies. The advantages claimed for this sub-station are small site area and low civil engineering costs.

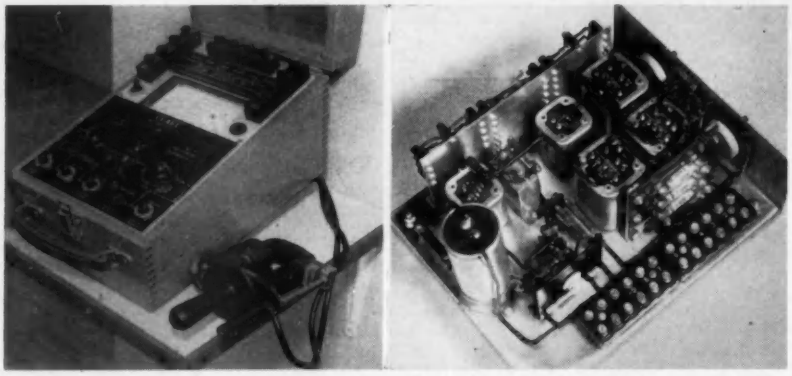
Another large exhibit was the 275 kV double-break, motor-driven isolator shown and demonstrated by Switchgear & Equipment. The centre post insulator lifts, and this movement twists the contact arm, so that there is a free entrance and exit from the contacts before the contact arm rotates to open the circuit.

Equipment for h.v. transmission systems was shown by a number of firms including the Electric Transmission Co., Ltd. This firm showed its range of "Dimex" lightweight low-capacity puncture-proof insulators. It is claimed that the electro-mechanical limitations of the conventional cap and pin insulator string have been surmounted by this new design. The insulator consists of a core of organic insulation, which functions completely immersed in compound contained in a shedded porcelain tube. The distance between the electrodes of a 33 kV insulator is 11½in giving a capacitance one-fifth the value of a conventional cap and pin string.

A multi-range a.c. test set was shown by the Clare Instrument Co. In addition to the measurement of a.c. voltages, currents, power and resistance, insulation resistance and earth loop impedance can be tested. The instrument can also be used as a phase sequence indicator. In the Mark IV central control equipment for fire warning shown by Sound Diffusion a pulse box is situated in each fire area and a single coaxial cable wired in a ring circuit interconnects these boxes with the central equipment.

Transformers and Rectifiers

The premier award for an industrial equipment exhibit was gained by the Brush Electrical Engineering Co., Ltd., with a 300 kVA, 3,300/565 V, three-phase mining transformer. One of the smallest items at the exhibition was the 400 c/s airborne transformer made by Fraser, Speller Transformers, Ltd., whose exhibit included 200/10,000 V



Left: Clare Instrument Co.'s multi-range a.c. test set with split core current transformer. Right: B.T.H. transistor automatic voltage regulator

units having a continuous output of 23 mA for oil burner ignition equipment. The low loss 15 kVA distribution transformer shown by London Transformer Products, Ltd., was housed in a die-cast case of Admiralty grade aluminium, giving a reduced weight, and consequent pole stress, without being liable to corrosion.

A high-speed, resistor transition, on-load tap-changer, the type DC3, for 33 kV transformers was exhibited by the transformer department of Ferranti, Ltd. The unit, which can be used with either star- or delta-connected transformers, is rated for a maximum full load line current of 300 A and has 16 steps. The type F on-load tap-changer on the Fuller Electric, Ltd., stand, shown at the exhibition for the first time, is also suitable for 33 kV transformers up to 10 MVA rating either star- or delta-connected. A contact life of 100,000 operations at full rated load is guaranteed. An on-load tap-changer equipment of the Jansen type shown by Transformers (Watford), Ltd., was said to be on view for the first time in this country. The example shown was suitable for 18-step fully-automatic regulation on a 10 MVA, 33 kV, three-phase transformer, but equipments are available for system transformers of all voltages and ratings.

Examples of silicon rectifier equipments were shown by Lancashire Dynamo Nevelin, Ltd., and Standard Telephones & Cables, Ltd., and the Hackbridge & Hewittic Electric Co., Ltd., displayed a 400 kW, 230-0-230 V d.c., three-wire germanium rectifier in addition to a selection of 33 kV overhead line gear and transformers.

Motors and Control Equipment

The many examples of electric motors which were on view illustrated the diversity of applications which have to be catered for and also demonstrated the fact that continuous and vigorous development work is being undertaken to ensure that the requirements of users are satisfied. For example, English Electric demonstrated a specially designed analogue equipment which is used for analysing servo problems.

Metropolitan-Vickers showed a 30/15 h.p., 8/10 pole, two-speed squirrel-cage motor with a pole-modulated tapping winding. The machine has a total of six leads out and is controlled by a standard switch unit for a tapped winding. The pole-modulated tapped winding was invented by Prof. G. H. Rawcliffe, of Bristol University, and it makes possible the design of a two-speed machine with a single tapped winding for pole numbers such as 8/10, 10/14, 14/16 and 14/22 provided the ratio of pole numbers does not exceed 1·5. Hitherto, it was necessary to wind two-speed motors having these pole combinations with two separate windings. The advantages of this new type of winding are that the size of machine is considerably reduced and the performance at both speeds is generally better than that obtained with a machine having two separate windings. There is no limit to the size of machine on which this type of winding can be used.

One running exhibit which typifies the company's work in the field of special machines developed to meet specific requirements was shown by Laurence, Scott & Electromotors, Ltd. It was one of a large number of 250 h.p., 3,000 r.p.m. squirrel-cage motors supplied to the U.K.A.E.A. and which have been designed to run for the minimum of two years without shut-down. It has forced lubrication of the bearings from a specially designed pump driven through spherical bevel gearing, with continuous filtration of the oil. An essential feature of the machine is the high degree of dynamic balance, much above normal commercial standards.

In a similar field of activity Lancashire Dynamo & Crypto, Ltd., showed one of twelve pony motors for the 4,400 h.p. gas circulator motors for Bradwell nuclear power station. These machines have a nominal output of 30 h.p. at 575 r.p.m. and a very high starting and accelerating torque coupled with the ability to withstand overspeeding to 3,800 r.p.m. An associated company, Lancashire Dynamo Nevelin, Ltd., demonstrated its recently-developed 30 h.p., three-phase "Varimag" magnetic amplifier variable-speed drive.

Another interesting item was the "Adjusto-Spede" infinitely variable-speed a.c. drive introduced by Heenan & Froude, Ltd. It comprises a fixed speed single- or three-phase f.h.p. induction motor mounted integrally with an eddy current variable-speed coupling. The motor and the coupling input member run at constant speed, while the speed of the output member, which extends through the unit so that power is available at either end, is infinitely variable. The electronic control unit is compact (5in square by 6½in long) and may be mounted remotely from the drive. The circuit is designed to allow close control of speed even when there are wide changes in load.

The wide range of motors shown by the British Thomson-Houston Co., Ltd., was exemplified by both totally-enclosed and ventilated machines made to British Standard dimensions. There was also a transistor automatic voltage regulator for use with single-unit self-contained alternators rated at up to 100 kVA, 50/60 c/s; it maintains the output voltage within ±1 per cent of its rated value. Essentially, the regulator consists of a Zener diode voltage sensitive circuit, a transistor amplifier, a rectifier supplying the exciter field power, and a stabilising circuit. The voltage sensitive circuit examines the alternator terminal voltage and produces an error signal when there is a departure from the normal value. This error signal, in turn, controls the exciter field through the transistor amplifier in the correct sense and degree to restore the alternator voltage. Transient negative feedback of the exciter armature voltage into the amplifier circuit ensures satisfactory damping of the voltage recovery following load changes.

A more general picture of what can be done by making use of electronic techniques was given by the Electrical Development Association's exhibit, the theme of which was "Electronics—the Key to Automation." The main display featured automatically operated and controlled equipment designed to reduce cost and increase productivity. Working demonstrations showing how electronics and automation techniques can be applied to production control and materials handling included printed circuit soldering equipment, an electronic weighing control system, a driverless battery-electric works truck, and an automatic component inserting machine.

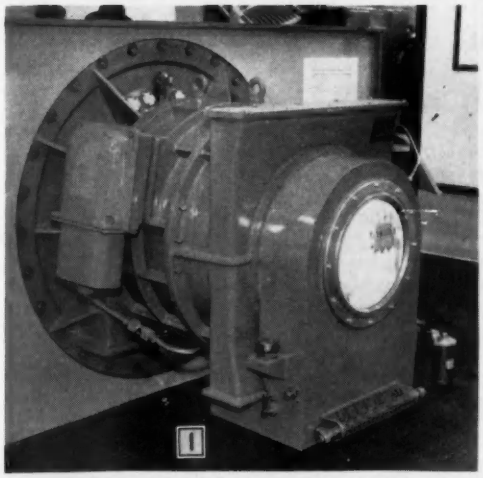
With the imminent publication of the International Electrotechnical Commission test for tracking resistance, attention in the United Kingdom is being focused on this method. The apparatus uses improved means for controlling the application of drops of electrolyte and, in addition, incorporates a more convenient form of electrode holder and provides for adjustment of the delay on the relay which determines the end-point of the test. These facilities will enable information to be obtained concerning details of the method with which the United Kingdom is not entirely satisfied. The C.E.E. test, although based on earlier drafts of the I.E.C. method, differs from it in significant detail. Although it is hoped that these differences will eventually be eliminated, there must be a period in the immediate future when both tests will need to be made. The E.R.A. apparatus can easily be adapted to either test.

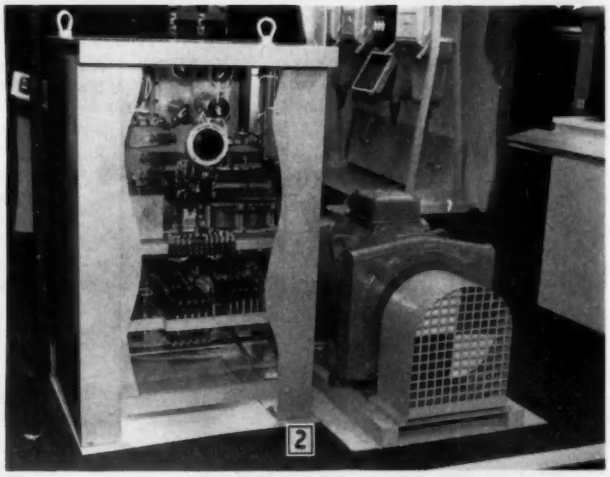
A new method of electrical transmission of turbo-alternator barring gear which was demonstrated by Elliott Bros. is suitable for the requirements of automatic starting and remote controlled power stations both conventional and nuclear. A standard a.c. turbo-generator combines a three-phase servo-generator which will follow faithfully over a speed range of 1-4,000 r.p.m. The estimated life of the receiver between overhauls is 18 months.

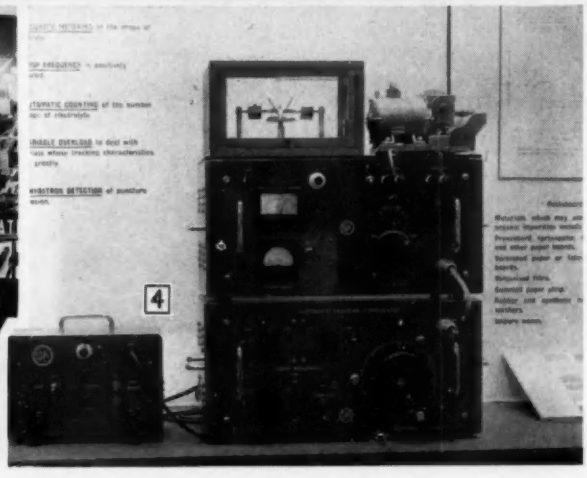
Cables, Trunking, etc.

The steadily increasing use of plastic insulated power cables was evident from the cable manufacturers' stands. B.I.C.C. showed such cables for 1,100 V working and polythene insulated p.v.c. sheathed 11 kV aerial power cables in addition to a complete range of paper, rubber and mineral insulated cables including a new 3·3 kV mass impregnated non-draining type. The Telegraph Construction & Maintenance Co., I td., also showed poly-

1. Laurence, Scott 250 h.p. 3,000 r.p.m. squirrel-cage motor. 2. Lancashire Dynamo Nevelin 30 h.p. "Varimag," a magnetic amplifier variable speed drive. 3. The paper pre-impregnating machine on W. T. Glover's stand. 4. E.R.A. prototype tracking resistance tester







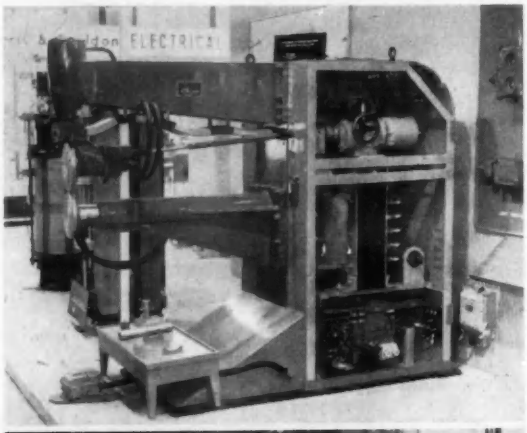
thene insulated h.v. power cables, including a 100 kV d.c. single-core submarine type which had been operating under service conditions for two years.

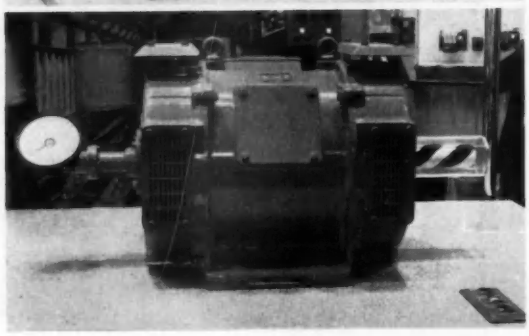
A 330 kV oil-filled cable for the Snowy Mountains Hydro-Electric Authority was displayed by Pirelli-General Cable Works, Ltd., who gave demonstrations of cable jointing including the making of cast resin joints on plastic mains cables. On the W. T. Henley's Telegraph Works Co., Ltd., stand demonstrations of terminating glands and new plastic joint boxes were given. The boxes are suitable for p.v.c. insulated mains cables having conductors up to 0·3 sq in and the range comprises straight-through, service and branch boxes. A new item also shown on this stand was a 33 kV oil-filled cable having an oval conductor.

Cable jointing, soldering and the use of compression tools was shown by the Northern Aluminium Co., Ltd., who also exhibited resin-filled joints in plastic insulated cables. The joined conductors are simply wrapped with a plastic gauze tape and covered with an adhesive tape to retain the resin. After linen reinforcing tape has been applied, resin is injected by a hand-operated gun and allowed to cure. A working model of a pre-impregnating machine for paper insulated cables was operating on the W. T. Glover & Co., Ltd., stand, paper being dried, vacuum treated, and impregnated, and the compound content controlled by scraper knives.

Among the many busbar and duct systems being exhibited Greenwood Airvac Conduits, Ltd., showed their most recent developments, including a remote adjustable floor frame in brass, and a universal floor pedestal unit, on a demonstration layout of their underfloor duct system suitable for 1½in screed, while Marryat & Place, Ltd., showed their "Barduct" system for 100 to 500 A distributors, metalclad bar system for 300 to 2,000 A feeders and open bar system for carrying currents up to 20,000 A.

Top: Siemens Schuckert water-cooled seam welder. Below: Metropolitan-Vickers two-speed squirrel-cage motor





Among the various cables and accessories exhibited on the Enfield Cables, Ltd., stand were products of the English Salvi Co., an Enfield Cables subsidiary, who manufacture in Great Britain the range of fittings developed by A. Salvi & Co., of Milan. On show was one of the large dead ends which will be used in the power line crossing the Rivers Severn and Usk, and also a ring-type spacer for bundle conductor e.h.v. lines.

Heating

A wide variety of the floor heating equipment now available of both the solid embedded and ducted rewirable types was shown, in some cases the element cable being obtainable in the form of prefabricated mats. In most systems the cable elements basically consist of a single-core conductor with enamel or terylene/glass protection and covered with a high-temperature grade p.v.c. A large number of such heating systems are thermostatically controlled and many manufacturers exhibited thermostats for this and other forms of heating. The "Thermo-Time" regulator exhibited by Robert Maclaren & Co., Ltd., is a combination of thermostat, time clock and switch, satisfying the control requirements of electric storage heating, since the time in the off-peak period during which the heaters are on can be varied with both the outside temperature and the residual heat in the building or storage medium. A newly-introduced motorised valve controlling radiators or zones in a hot water or steam heating system, with a room thermostat for control, was shown by the Rheostatic Co., Ltd. A range of air flow unit heaters with heater loadings varying from 3 to 15 kW, in which air is blown by a fan through an electric heating element and directed by adjustable louvres, was shown by Fenton Byrn & Co., Ltd. Forced air circulation ovens were among the furnaces and other industrial heating equipment displayed by Hedin, Ltd.

Among the infra-red domestic and industrial heaters exhibited were G.E.C. Osram tubular units of 500 and 1,000 W rating. The quartz envelope of these has a sufficiently high resistance to thermal shock to withstand, without suffering damage, quenching with cold water when at full working temperature. A selection of industrial infra-red heating elements was shown on the Metropolitan-Vickers Electrical Co., Ltd., stand with a section of a paint stoving oven of a type readily constructed using M-V elements mounted on an angle iron or slotted angle framework.

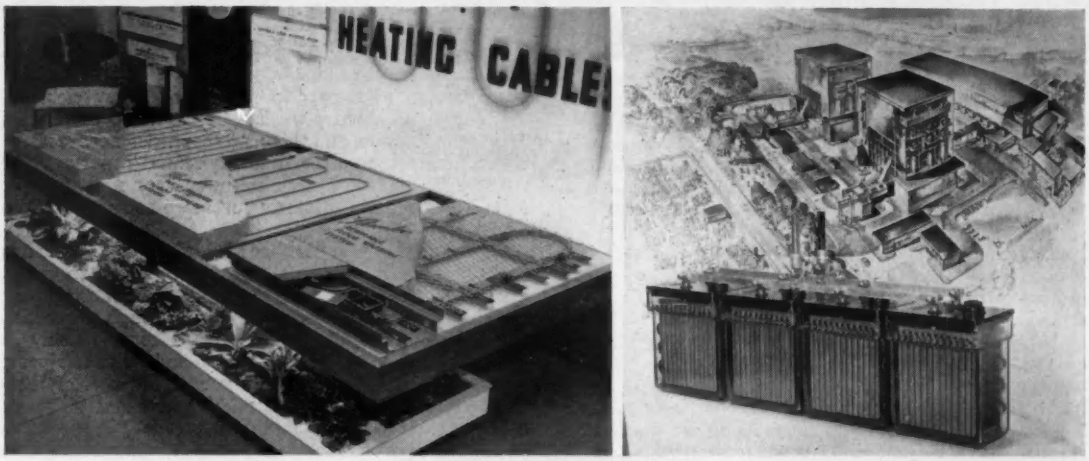
Batteries

A type WMN25, 3,600 Ah, 2 V cell was shown on the Siemens Edison Swan stand. The cell, which weighs approximately 1 ton, and consists of 51 bedplates spaced by glass tube separators assembled in a lead-lined wooden container, is of a type made to special order, and supplements the company's standard range of storage batteries and battery chargers.

Four type LHX25 cells, which will form part of the reactor essential services battery at Hinkley Point nuclear power station, were shown on the Pritchett & Gold & E.P.S. Co., Ltd., stand. Each 520 V reactor battery will comprise four banks of 236 similar cells.

Welding

New welding equipment introduced by Meritus (Barnet), Ltd., included a foot-operated butt welding



Left: Under-floor heating cables on the B.I.C.C. stand. Right : A Pritchett & Gold & E.P.S. display showing four of the cells which will form part of the reactor essential services battery at Hinkley Point

machine and a bench type spot welder complete with a cyclic timer. On the Siemens-Schuckert stand exhibits included a WS7U water-cooled seam welder, capable of welding both long and end seams, the upper electrode being turned through 90 deg and the lower electrode holder replaced to accommodate the alternative seam form. A pneumatically-operated resistance welding machine for plastic-coated sheet steel was shown by Hirst Electronic, Ltd., together with new 25 and 60 kVA resistance spot welders.

BRITISH REFRIGERATION INDUSTRY

Association's Annual Luncheon

MR. E. G. ROWLEDGE (chairman) presided at the annual luncheon of the British Refrigeration Association at the Connaught Rooms, London, W.C.2, on Friday last. Mr. John Rodgers, Parliamentary Secretary, Board of Trade, who was to have been the principal guest, was prevented from attending by Parliamentary business and he was represented by Mr. T. L. Iremonger, M.P.

In presenting the toast of the Association Mr. Iremonger praised the refrigeration engineer's contribution to the air-conditioning system of the House of Commons. He went on to say that the industry's home market had been greatly stimulated by the halving of purchase tax on domestic refrigerators and the removal of hire-purchase restrictions. Export trade was dependent upon a good home market and although the home demand had temporarily reduced the proportion of production sent overseas he hoped that the industry would again get back to the two-thirds of production which it had exported during the past few years.

The industry needed a great deal of ingenuity, technological skill and drive; it was the kind of industry upon which the country relied for the maintenance of export trade. There were difficulties in most overseas markets. We had looked forward to the opening up of new markets by the institution of a European Free Trade Area but hopes had so far been disappointed. The Government still believed that something of the kind was the best thing for Europe and hoped to find ways of resuming negotiations and thus avoid discrimination against British exports.

Another hope of the Government was that firms expanding their production would set up works in the areas in which employment was needed. Firms should consult the Board of Trade, to their own advantage and that of the country as a whole.

Replying for the Association, Mr. Rowledge referred to Mr. Rodgers and Mr. Iremonger and praised the Board of Trade's statistical service which, he said, was most useful to members. He welcomed the halving of the purchase tax and the removal of hire-purchase restrictions but expressed the hope that in the forthcoming Budget the tax would be removed altogether. As the older industries declined new ones, such as theirs, must be encouraged to expand; this had been the effect of removing the restrictions and while home consumers had benefited it would also encourage exports.

Continental manufacturers, unhampered by restrictions, had made great headway and competition in Europe had become more difficult. The refrigeration industry hoped for an early resumption of negotiations for a Free Trade Area as it would provide the industry with great opportunities. If matters remained as they were at present the industry would be greatly handicapped; already the loyalty of some of their Continental distributors was being strained.

There was a need for more trained engineers. The National College of Heating, Ventilating, Refrigeration and Fan Engineering had been handicapped by lack of facilities but now the Ministry was prepared to make a grant of four-fifths of the cost of new premises; the balance had to be found by the industry itself and he asked for support of the appeal which the governors were making.

Mr. Rowledge then proposed the health of the guests and Mr. Norman Collins' reply, in a delightfully humorous strain, was well received.

B.E.A.M.A. ANNUAL MEETING

THE achievements of the electrical manufacturing industry and the efforts of the British Electrical and Allied Manufacturers' Association to make these better known formed the twin themes of the chairman of the Council's address at the forty-eighth annual meeting of the Association, which was held at the Connaught Rooms, London, on 19th March.

In presenting the annual report, which was summarised in our last issue, Mr. J. O. Knowles said that the industry's reputation for hiding some of its light under a bushel did not accord with the pace of the formation of public opinion. The industry's trade was dependent on the actions of the British and other Governments, which must take account of industrial and public opinion in this and other countries. Recent work of the B.E.A.M.A. to educate public opinion at home and abroad had included the B.E.A.M.A. Catalogue, participation in the Brussels and Geneva exhibitions, and publication of two complementary booklets, "Serving the World" and "Leading the World." This year, he said, it seemed specially important that it should be made known that the industry was not "failing the nation."

After referring to the close co-operation with the supply industry, Mr. Knowles said that with leadership in research and development and ability to meet foreign competition, further expansion in trade overseas depended on the extent to which methods could be found for financing more British capital projects abroad.

Since 1950 British manufacturers' production capacity of heavy electrical generating plant had increased by over 60 per cent to an annual capacity of over 3,000 MW. Last year more than £10 million of heavy electrical machinery and allied plant had been sold to the United States and Canada, and these two countries now received about 10 per cent of the industry's total exports. The 1958 figure for heavy electrical machinery exports was a record and exports of steam turbine plant increased by 24 per cent.

Though the capital cost per kWh of steam stations had been kept practically constant for the last 10 years, despite a 70 per cent rise in wages and materials, this had been achieved only by employing a high proportion of technologists and technicians. Approximately a quarter of all qualified engineers and scientists were employed by electrical manufacturers and half of them were engaged on research and development on which the industry spent about £35 million a year.

The industry was much concerned to maintain stable conditions of employment. In engineering it was necessary to think more than one year ahead, and Mr. Knowles placed much emphasis on the harmful effects of the Government's "coarse" control of the economy by artificially contrived changes in demand which upset manufacturers' plans for progressive expansion of investment and capacity. In Europe the B.E.A.M.A. hoped that a middle way would be found between unrestricted co-operation and unrestricted competition, the latter being the greater danger. On the commercial as well as the technical side the industrial answer to the problems of inter-trading and inter-dependence in Western Europe was tending towards closer relations between the Association and similar bodies in Western European countries.

POST OFFICE PROGRAMME

ESTIMATES of capital expenditure by the Post Office are contained in a White Paper issued last week. (Cmnd. 690, H.M. Stationery Office, price 6d.) The total outlay for 1959-60 is put at £90 million, a further reduction, and the lowest amount since 1955-56. Telephone development again accounts for the bulk of the expenditure, although the figure of £69·6 million is lower than that for 1958-59 (£72·8 million). In the telephone section the largest item is £18·4 million for exchange equipment; then follow subscribers' circuits (£17·9 million), local lines (£17·2 million) and trunk and junction circuits (£14·9 million).

A list of the twenty major exchange schemes shows the extension of subscriber trunk dialling (S.T.D.) to eleven new or extended exchanges, including Leicester new exchange (£1·15 million), the new London S.D.T. unit (£0·78 million), Newcastle-on-Tyne extension (£0·64 million), Liverpool trunk extension (£0·56 million), and Bolton new exchange (£0·56 million). It is expected to add a total of 270,000 exchange connections during 1959-60. Altogether the installation of equipment is to be started for 60 new automatic exchanges, including 40 manual-automatic conversions, and 80 extensions.

Among the major trunk and junction circuit schemes are:—Birmingham-Derby-Nottingham (£0·64 million), Manchester-Newcastle-on-Tyne (radio) (£0·58 million) and Liverpool-Manchester (£0·43 million).

The Post Office plans to give service to 370,000 applicants during 1959-60 and at the close of the year there should be 7·6 million telephones in the United Kingdom.

A new cable from the United Kingdom to Sweden is projected; the cost (£1·6 million) will be borne in equal shares by the Post Office and the Swedish P.T. & T. Administration. An order for a new cable ship costing £0·5 million is to be placed.

Inland telegraph works are to be carried out at a cost of £3·3 million. Installation will proceed on 18 out of the 22 automatic telex exchanges and considerable work will be done in converting subscribers' equipment. The aim is complete automatisation of the service by the end of 1960. Other expenditure will be under the headings: Postal installations (£0·3 million), general services works (£3·2 million) and sites and buildings (£13·2 million).

At the end of 1958 there were 146,339 outstanding applications for telephone service—38,025 fewer than a year earlier.

Symposium on Biomechanics

IN view of the growing importance of the applications of mechanical engineering in the fields of medicine and surgery, the Institution of Mechanical Engineers has arranged a symposium on biomechanics to be held at the Institution, 1, Birdcage Walk, Westminster, London, S.W.1, on 17th April. Registration is required and forms can be obtained from the secretary of the Institution. Admission is not restricted to members.

INDUSTRIAL NEWS

Deuce Computer at Liverpool University

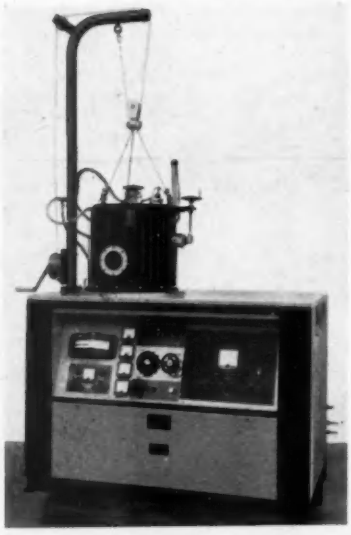
The University of Liverpool has ordered a Deuce electronic digital computer from the English Electric Co., Ltd., and the machine, a Mark I, is being installed at the University's Ashton Hall mathematical laboratories. The computer will be operational in the early summer and will enable the laboratories to expand very considerably the services they offer both to university departments, such as the nuclear physics and oceanographic department, and to outside organisations. Free time on the computer will also be offered, as it becomes available, to local industry on a time-hire basis.

Commercial Education

The Advisory Committee on Further Education for Commerce, set up by the National Advisory Council, has issued its report (H.M. Stationery Office, price 2s 6d), and among its recommendations are proposals for the introduction of sandwich courses in commercial subjects, on the lines of those already established in the field of technology, and the creation of a new national award for students in colleges and departments of commerce who have successfully taken advanced sandwich courses to degree level.

Valve Processing Under Vacuum

The components of ceramic valves for radar and micro-wave use have to be assembled under an extremely high vacuum to ensure complete de-gassing since it is not possible to use a getter to remove residual gas, the process employed with conventional radio valves. A pumping plant handling up to six 11in diameter ceramic disc valves simultaneously, has been developed by Edwards High Vacuum, Ltd., of Crawley, Sussex, in conjunction with a French company. The unit comprises a water cooled vacuum chamber with furnace equipment, operating at temperatures up to 1,100 deg C for brazing, and valve turntable, evacuated by rotary and diffusion pumps. These can attain a final vacuum of 10^{-6} mm Hg. The metal cabinet also contains the instrument panel for vacuum and temperature measurement, and voltage control equipment.



Vacuum plant for valve processing

Professor L. Rosenhead, head of the Mathematical Laboratory, Liverpool University (facing the camera), with Mr. A. Young, also of the laboratory, inspecting the progress of the installation of an English Electric Deuce computer at the University

Australian Import Licensing

It was recently announced by Mr. J. McEwen, the Commonwealth Trade Minister, that the level of licensing of imports into Australia would remain unchanged for the four-month period beginning on 1st April.

Winder Motors for N.C.B.

An order valued at about £100,000 has been placed with the General Electric Co., Ltd., by the North Eastern Division of the National Coal Board for one 400 h.p. and one 1,000 h.p. a.c. winder for Elsecar Colliery. The mechanical parts will be built by Fullerton, Hodgart & Barclay, Ltd. The 400 h.p. winder will have a parallel two-compartment drum for double-layer coils and is designed to raise men and materials from 1,355ft, operating from three levels. The 1,000 h.p. machine will have a single drum for single-layer coils, and will raise 235 tons of coal an hour from a depth of 1,079ft. A 3,300 V three-phase, 50 c/s supply serves both winders. They will have compensated dynamic braking, although provision is made for fitting a speed control system at a later date.

Contract Price Formulæ

The British Electrical and Allied Manufacturers' Association has issued the figures for its contract price adjustment formulæ. In each case the rate of pay for adult male labour at 13th March is deemed to be 194s.

The "costs of materials" figures are: For electrical machinery and equipment the Board of Trade index figure published on 13th March is 179·6 (1949=100) and 115·8 (1954=100); both figures are provisional. For turbo-generating and allied plant: Materials used in mechanical engineering industries 186·9 (1949=100) and 124·4 (1954=100); both figures are provisional. Blast furnaces and iron and steel melting and rolling (40 and 41) 190·8 (1949=100) and other steel goods, excluding tubes (311 and 312) 130·0 (1954=100). The price of ¾in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 13th March) is 48½d per lb.

Scottish "Try It Yourself" Exhibition

A new concept in demonstrating modern electrical appliances was an electrical "Try it Yourself" exhibition, presented by the South of Scotland Electricity Board, in the Scottish Building Centre, Glasgow, from 10th to 15th March. Visitors were

encouraged to handle electrical appliances themselves. Auto-time cookers, infra-red grills, a "Rotisserie," were all ready for use, as were many laundering and cleaning aids. The exhibition was formally opened by the Lady Provost of Glasgow, Mrs. Myer Galpern.

Marine Radar

A new marine radar, "Escort," produced by the British Thomson-Houston Co., Ltd., was demonstrated recently in the Thames estuary. The equipment basically comprises four units: a motor-alternator set available in alternative versions for ships having either a.c. or d.c. mains, a transmitter-receiver unit, a scanner and a 12in display unit. Four forms of P.P.I. display are available to meet the requirements in various situations. With chart plan presentation the centre

Display unit of the "Escort" marine radar

of the rotating sweep, i.e. the ship's position, is moved across the display in the direction of the ship's heading marker at a speed corresponding to the ship's speed. Echoes from stationary objects appear as stationary echoes giving a fixed reference while echoes from moving objects show, from the tail produced by the tube persistence, their true course. To obtain closest approach distance and other relative data the chart plan shift generators can be temporarily stopped so that the tails of other moving echoes will then indicate their relative courses. Other displays are also relative, either "north upwards" or "ship's head upwards."

Particular consideration has been given in the design stages to simplifying the controls and to reducing the complexity of the equipment to the essential minimum, ensuring easy and reliable operation. Directly below the c.r. tube face are five small panels which illuminate, showing abnormal conditions. Two remind the operator that the aids to picture analysis have been switched in and the others give warning of faults or maladjustments which might not otherwise be observed.

The equipment, operating at 9,500 Mc/s, has seven ranges up to 48 nautical miles with a range accuracy of ±2 per cent and a bearing accuracy of ±½ degree. It operates from a 380/440 V, three-phase, 50 c/s a.c. or a 110 or 220 V d.c. supply and the total power consumption is 1·3 kW.

Pumps for Southern Outfall Works

A contract valued at £81,604 recently awarded to Gwynnes Pumps, Ltd., includes ten 21in/24in automatically operated mixed flow pumps each of 8,800 g.p.m. at 22ft total gauge head, and four 9in/10in automatically-operated centrifugal pumps each of 1,700 g.p.m. at 100ft total gauge head. The contract also includes one 5-ton Vaughan overhead travelling crane, motors by Laurence, Scott & Electromotors, Ltd., and complete control gear by Watford Electric & Manufacturing Co., Ltd. The work is being carried out under the direction of the chief engineer of the L.C.C., Mr. J. Rawlinson, assisted by his divisional engineer (mechanical), Commander S. V. Jackman.

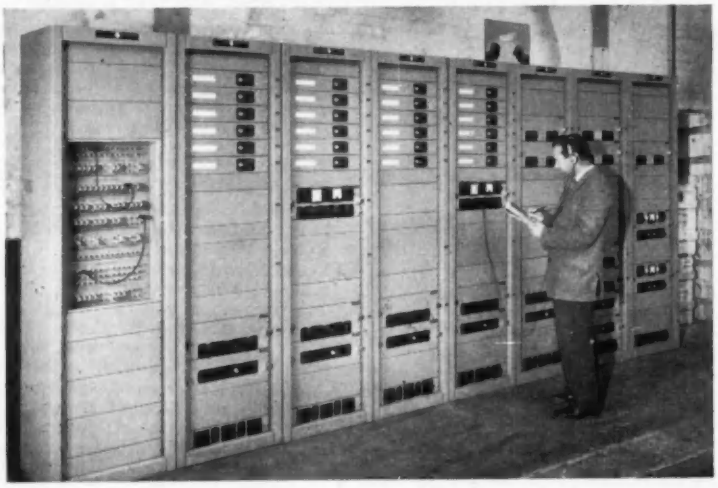
Aircraft Cables

Henley cables are being used in the new "Argosy" freightercoach introduced by Sir W. G. Armstrong Whitworth (Aircraft), Ltd., early this year. Among the cables supplied are "Tersil" cables, miniature cables and equipment wire.

Maldive Islands Radio Station

A contract for the planning, supply and installation of a high power radio station at the R.A.F. staging post in the Maldive Islands in the Indian Ocean has been placed with the Marconi Wireless Telegraph Co., Ltd., by the Ministry of Supply on behalf of the Air Ministry. Fourteen high frequency independent sideband transmitters will be installed in the transmitting station at Hitaddu, four of 30 kW, two of 10 kW and eight of 3·5 kW output. The receiving station on the island of Gan, some six miles away, will incorporate six triple diversity receivers, three double diversity telegraph receivers, two frequency-shift diplex receiving units and two six-channel, two-tone voice frequency telegraph equipments. A duplicate s.h.f., multi-channel system will be employed for communication between the two islands.

Part of the equipment to be installed in the Maldive Islands



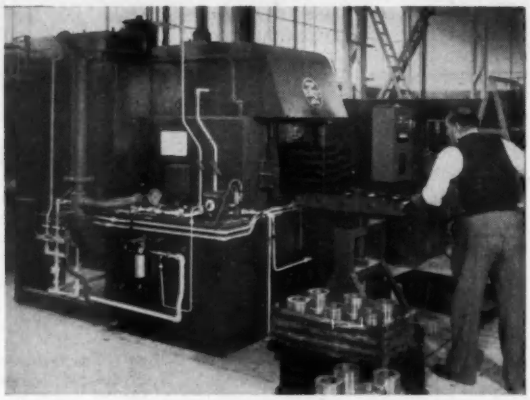
Tait's Electrical Directory

It is some years since the last edition of "Tait's Electrical Directory of Australia and New Zealand" was published, and the 1958-59 edition therefore contains much new information concerning the various electricity supply undertakings. Particulars are given of the type and capacity of plant, transmission and distribution systems, number of consumers, population in supply area, tariff statistics, and names of officials. The consolidation in New South Wales of many local government areas in County Districts for the purpose of electricity supply has necessitated a re-arrangement of material in this section. The directory is published by the Tait Publishing Co. Pty., Ltd., 349, Collins Street, Melbourne, C.1, Victoria, Australia, price £3 Australian.

Heat Storage Brooder

A new heat storage chick brooder has been developed by the agricultural engineer to the Eastern Electricity Board, Mr. E. C. Claydon, which provides brooding facilities at low cost and is unaffected by temporary interruptions in power supply. Experimental installations, constructed in existing poultry houses, have been operating satisfactorily in Buckinghamshire, Suffolk and Essex. A 12-hour charging period is generally ample to maintain the desired temperature although in exceptionally cold conditions advantage may need to be taken of the midday boost provided for under the Board's off-peak tariffs.

The soil from an area 6ft by 6ft is



Birlec's new Heat Treatment Division showing a 40 kW sealed quench furnace

excavated to a depth of about 1ft and is filled with the heat storage material, which can be sand with a top layer of paving slabs, or concrete. There are two layers of plastic insulated heating cable, one 1in from the bottom of the storage material and the second 6in above the first; the cable is laid in 24 lengths with an approximate spacing of 3in and the total loading is 1 kW. Heat insulation is provided by glass fibre in the bottom of the pit and around the sides. Each of the brooding areas can accommodate 1,000 day-old chicks and the temperature of about 100 deg F is maintained with little variation, at least for the first seven days. A focal point for the chicks is provided by low voltage filament lamps supplied by a battery with trickle charger.

South Wales Docks Modernisation

The British Transport Commission announce schemes of improvement and modernisation at the South Wales ports (comprising Newport, Cardiff, Penarth, Barry, Port Talbot and Swansea), at a total estimated cost of £1,125,000. The programme will include the provision of nine new electric cranes with a radius of 70ft and on a gauge of 15ft at No. 4 Quay, King's Dock, Swansea, which will replace obsolete hydraulic appliances of lower capacity, and the hydraulic system at Swansea will be further curtailed by the closing of the three existing hydraulic power stations and their replacement by five electric pumping stations.

Careers Booklet

Hoover, Ltd., have issued an illustrated booklet intended mainly for university graduates who are thinking of taking up a career in sales, engineering or production in which it describes the opportunities which are open with the company.

Heat Treatment Service

The Heat Treatment Division of Birlec, Ltd., has been formed specifically to provide a contract heat treatment service to industry. It also serves as a means of demonstrating a selection of standard "Birlec" heat treatment furnaces under normal operating conditions. The works at Aldridge provide capacity for the following heat treatment processes:—Bright annealing and normalising; clean hardening and tempering; nitriding; carburising and carbo-nitriding; low temperature treatments; and furnace brazing. Supplementary to this list of processes, capacity is also available for degreasing, copper plating and descaling.

Clean Air Film

In our 13th March issue we reported the showing by the South of Scotland Electricity Board recently of the new E.D.A. film, "The Future is Electric," in Edinburgh, when the Board's chairman, Sir John Pickles, introduced the film to a large audience of town councillors, government and local government officials, architects and representatives of professional bodies. The film was shown in support of the local authorities and other organisations now preparing to implement the Clean Air Act.

The film was given a second showing in Glasgow on 9th March, when the deputy chairman of the Board, Mr. W. Hutton, introduced the film to a similar audience. The Lord Provost, Mr. Myer Galpern, gave a short address on how the Act will affect the City area. In conjunction with the presentation of the film, an exhibition was arranged displaying the many ways in which electricity can best solve the problems arising out of the Clean Air Act.

At the showing of the E.D.A. film "The Future is Electric" in Edinburgh. Left to right: Mr. J. W. Moule, chief commercial officer, and Sir John Pickles, chairman of the South of Scotland Electricity Board, Lord Forbes and Bailie A. D. Jameson examine an underfloor warming model

Substation Equipment for Durban

Cooke & Ferguson, Ltd., a member of the Crompton Parkinson group of companies, has been awarded a contract by Durban Corporation for a new substation at Mitchell Park. The equipment to be supplied includes a 5-unit FE5 single busbar, 33 kV, 750 MVA metalclad switchboard and a 12-unit FTD 4/5 double busbar, 6·6/11 kV, 250 MVA metalclad switchboard. The value of the switchgear, excluding the control panels which will be built in South Africa, will be approximately £36,000. The Cooke & Ferguson agents in South Africa are Arthur Trevor Williams (Pty.), Ltd., Johannesburg.

Works Visit

Accompanied by executives of the British Thomson-Houston Export Co. and representatives of the B.T.H. Co. in Spain, Senor Don Francisco March, Deputy Director-General, Fuerzas Electricas de Cataluna S.A., Spain, spent two days at the Rugby Works, on 16th and 17th March, for conferences with directors and managers. Senor March was welcomed by Mr. E. V. Small, director of the B.T.H. Co. and managing director of the B.T.H. Export Co. The second day was devoted chiefly to a tour of the works, departments visited including fabrication, heavy plant, transformer, turbine, generator, motor and control gear.

Libraries for Industry and Commerce

The Tyneside Association of Libraries for Industry and Commerce (T.A.L.I.C.) has issued a brochure briefly describing the service which it offers. The Association has been

organised under the sponsorship of the Northern Regional Board for Industry, the Tyneside Productivity Committee, and the North East Industrial and Development Association. Its main purpose is to co-ordinate and develop existing facilities in the Tyneside area in order to help industry and commerce by making information readily and quickly available. The use of the service is free. The headquarters of the Association are at the Commercial and Technical Department of the Central Library, Newcastle-on-Tyne.

Bank Station "Travolator"

Passengers using "The Drain"—the Southern's underground line to the Bank—have received copies this week of a 12-page booklet on the new "moving pavement" at the Bank station. The booklet contains a full description, together with detailed drawings, of the "Travolator," the 300ft-long moving pavement which will take passengers between the Bank station and the platforms in two minutes. The twin-track "Travolator" will be in operation by the end of August, 1960.

E.C.A. Conference

Provisional details of the programme for the annual conference of the Electrical Contractors' Association (Eastbourne, 14th-16th June) have now been circulated to members.

On Sunday, 14th June, delegates will register and there will be a "get-together" at the Grand Hotel in the evening. Monday's proceedings will include the usual civic welcome, the presidential address by Mr. C. C. Hyams and the annual general meeting; the evening function will be a reception by the Mayor of Eastbourne followed by a dance.

A paper on "Specialised Industrial Applications and Installations" will be read by Mr. R. A. Joseph, B.Sc., M.I.E.E., on the Tuesday morning, followed by a discussion. In the afternoon there will be a debate on the proposition "That Society is Better Served by Independent Business Undertakings than by Large Amalgamations"; the proposer will be Mr. J. Mortimer Hawkins and the opposer Mr. V. J. Stock (vice-president). The business will conclude with the installation of the new president and in the evening the president will hold a reception, and a dance will follow.

Labour Costs in U.S. Contracts

A challenge to United States electrical manufacturers who are opposing the award of contracts for generating plant to foreign companies was made in Geneva last week by Mr. J. B. Carey, president of the International Union of Electrical, Radio and Machine Workers, which organises the employees of General Electric and Westinghouse. He disclosed the text of a letter he had written to President Eisenhower urgently asking for an impartial examination of the facts.

Among other things, Mr. Carey said, American companies had claimed that the main differential in the bids was due to higher labour costs in the United States. His union had looked into this and found that the Tennessee Valley Authority had estimated that one million man-hours of labour would be involved in the production of the turbo-alternator ordered from Parsons. Assuming that labour costs were about $3 an hour, the total labour costs of this particular contract would therefore be roughly $3 million. That meant, he pointed out, that even if Westinghouse had not paid "a penny piece" for its labour it still could not have met the Parsons' bid. The differential was about $5·5 million and the labour costs only $3 million.

His union had asked the U.S. Government to take no precipitate action because they believed that the companies' protests might have little, if any, merit. They had pointed out that the pricing policies of the companies might have been responsible for the highness of the bid and the insistence by the companies on a very high rate of profit might also have played a part.

Trade Announcements

Martonair, Ltd., have ceased to be represented in the North-West by R. G. Smith (Accrington), Ltd., and have appointed two new technical representatives in this area—Mr. G. Parfett (Liverpool, Chester and Preston) and Mr. C. F. Holding (Leeds, Bradford and Wakefield). The new representatives take up their appointments on 1st May and will operate from a new office which will be opened at 66, Mosley Street, Manchester, 2 (telephone: Central 0032), on 13th April under the managership of Mr. E. Donlon.

The **Denis Ferranti Co., Ltd.,** Royton, Oldham, announces that **Caselco, Ltd.,** 46, Park Square, Leeds, 1 (telephone: 30993), who are its agents in Yorkshire for power transformers, voltage regulators and reactors, will in future also represent it in the East Midland Division of the National Coal Board for both mining and industrial applications.

The **David Brown Corporation (Sales), Ltd.,** Huddersfield, has appointed Mr. W. A. Griffin area sales engineer (South Wales) for its industrial gear division products.

The address of the Cambridge branch office of **British Insulated Callender's Cables, Ltd.,** will be 65, Devonshire Road, Cambridge, as from 31st March. The telephone number (Cambridge 55451/2) is unchanged.

From 1st April both **F. Hulme & Co., Ltd.,** and **G. Ellam, Ltd.,** will be operating from a new address at 42, Whitworth Street, Manchester, 1 (telephone: Central 0925/6/7), with stores and trade counter in Brazil Street (at the rear of 42, Whitworth Street).

Erie Resistor, Ltd., has closed its premises at Carlisle Road, The Hyde, N.W.9, and the Sales Department is now at 1, Heddon Street, London, W.1 (telephone: Regent 6432).

Changes in U.K.A.E.A. Organisation

It is announced that changes are to be made in the organisation of the United Kingdom Atomic Energy Authority as from 1st July. Hitherto the Authority has been made up of three Groups: Research, Weapons, and Industrial. The Industrial Group has become too large for convenient management and will now be divided into a Development and Engineering Group and a Production Group. At the same time the full-time technical members of the Authority will again assume executive responsibility for particular Groups in addition to their functional responsibilities and general duties as members of the board.

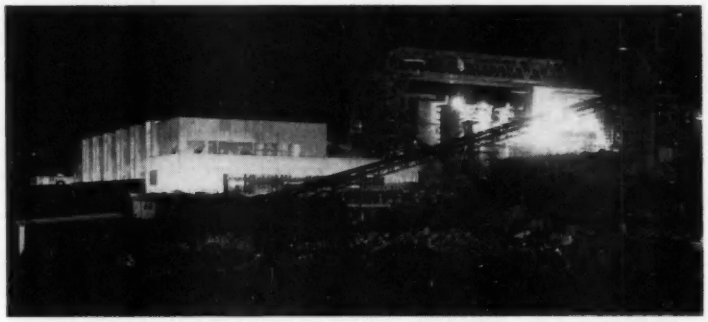
Sir William Cook, with the title of member for development and engineering, will be executive head of the Development and Engineering Group and will in addition retain corresponding functional responsibilities throughout the Authority. Sir Leonard Owen will have the title of member for production (designate) and will be the executive head of the Production Group. Sir William Penney, whose appointment to succeed Sir John Cockcroft as the member for scientific research has already been announced, will in addition become the executive head of the Research Group while retaining his responsibilities for scientific research throughout the Authority.

Japanese Nuclear Power

According to a *Reuter* report, the negotiations for the importation into Japan of a Calder Hall type nuclear power plant have progressed sufficiently to enable the Japan Atomic Power Co. to make concrete preparations for its construction. It is likely, therefore, that the company will soon be supplying the G.E.C.–Simon-Carves Atomic Energy Group with a letter of intent for the 150 MW plant.

It is announced that Mr. Tamaki Ipponmatsu, vice-president of the Japanese company, was to leave for London on 22nd March to negotiate for a technical assistance agreement with the United Kingdom Atomic Energy Authority on uranium fuel, and with the G.E.C.–Simon-Carves Group on a guarantee regarding generating capacity and the return of used fuel. It is understood that the construction of the plant will be completed by 1963.

GENERATION and DEVELOPMENT



Night scene at Bradwell: This photograph was taken from the south-west corner of the site looking towards the Blackwater Estuary. The illuminated, rectangular building on the left is the turbine house which will accommodate six 52 MW main turbo-alternators and three 15·2 MW auxiliary sets. In the centre of the photograph, the Goliath crane straddles No. 1 reactor where three of the six heat exchangers can be seen. The structure running diagonally from left to right is the conveyor belt for the main concrete batching plant

Higher Output

The February statement issued by the Ministry of Power shows that 9,522 million kWh was generated by public supply authorities in this country, an increase of 9·1 per cent over February, 1958. Although this rate was a little lower than in January it was well above the average for last year. In addition, 901 million kWh was generated by industry in the four weeks ended 28th February, 2·6 per cent more than in the corresponding period of 1958. This included 61 million kWh provided by nuclear power stations, two and a half times as much as a year ago.

The monthly statistics issued by the Electricity Council show that the sales of the twelve Area Boards in England and Wales were 10 per cent higher in February than in the same month last year (when corrected for weather conditions and working days the effective increase is 8·2 per cent). Supplies in the South of Scotland Board's area last month totalled 666 million kWh, an increase of 9·8 per cent. This figure included 74·5 million kWh imported from the C.E.G.B. (against 24·8 million a year ago) and 46·9 million from the North of Scotland Board (against 53·1 million) with a small supply from the newly commissioned Chapelcross station of the Atomic Energy Authority.

Area requirements of the North of Scotland Board in February amounted to 152·6 million kWh, against 145·8 million in February, 1958, an increase of 4·7 per cent.

ELECTRICITY GENERATED AND PLANT INSTALLED

	Fuel consumed Thousand tons			Electricity generated Million kWh			Electricity sent out Million kWh	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
Central Electricity G.B. ...	3,888	103	337·6	8,725	5	8,736	8,229	25,364
North of Scotland H.E.B. ...	26	—	1·7	45	158	210	207	1,011
South of Scotland E.B.	297	4	0·3	560	16	576	544	1,658
Total for February, 1959	4,211	107	339·6	9,330	179	9,522*	8,980	28,033
Corres. total for February, 1958	4,193	89	122·2	8,468	243	8,726	8,224	26,635
Inc. or dec., per cent	+0·4	+20·4	+177·8	+10·2	−26·2	+9·1	+9·2	+5·2
Total to date (2 months), 1959...	9,222	221	721·6	20,160	410	20,601	19,437	
Total for corres. 2 months of 1958	9,132	191	247·6	18,267	502	18,802	17,721	
Inc. or dec., per cent	+1·0	+16·0	+191·4	+10·4	−18·3	+9·6	+9·7	

* The total figure includes generation by other methods amounting to 13 million kWh.

ELECTRICITY SENT OUT BY BOARDS FOR THEIR CONSUMERS

Board	Totals for February Million kWh			Twelve Months Totals Ended 28th February Million kWh		
	1958	1959	Inc. or Dec.%	1958	1959	Inc. or Dec.%
London	724·0	825·8	+14·1	7,267·0	7,872·1	+ 8·3
South Eastern	461·8	532·7	+15·4	4,742·3	5,349·1	+12·8
Southern	583·7	689·8	+18·2	5,976·5	6,812·6	+14·0
South Western	265·7	310·8	+17·0	2,926·0	3,252·8	+11·2
Eastern	741·4	838·7	+13·1	7,675·5	8,413·6	+ 9·6
East Midlands*	599·2	660·9	+10·3	6,477·7	6,964·6	+ 7·5
Midlands*	795·8	883·2	+11·0	8,328·1	9,062·8	+ 8·8
South Wales*	418·4	434·9	+ 3·9	4,857·9	5,118·8	+ 5·4
Merseyside and N. Wales* ...	453·9	490·9	+ 8·2	5,071·9	5,432·4	+ 7·1
Yorkshire*†	770·3	802·4	+ 4·2	8,426·0	8,713·5	+ 3·4
North Eastern*	447·2	463·7	+ 3·7	4,894·6	5,124·3	+ 4·7
North Western*	801·3	836·1	+ 4·3	8,673·8	9,075·6	+ 4·6
Total all Area Boards	7,062·7	7,769·9	+10·0	75,317·3	81,192·2	+ 7·8
Direct Supplies by C.E.G.B. ...	222·7	247·6	+11·2	2,532·7	3,031·3	+19·7
Grand Total	7,285·4	8,017·5	+10·0	77,850·0	84,223·5	+ 8·2
Mainly Industrial Areas*	4,286·1	4,572·1	+ 6·7	46,730·0	49,492·0	+ 5·9
Mainly Non-Industrial Areas ...	2,776·6	3,197·8	+15·2	28,587·3	31,700·2	+10·9
South of Scotland E.B.	606·8	666·0	+ 9·8	6,265·0	6,785·4	+ 8·3
North of Scotland H.E.B. ...	145·8	152·6	+ 4·7	1,443·0	1,565·8	+ 8·5

* Those in which industrial consumers took over 50% of the total sales in the preceding financial year.
† The Yorkshire Board is at present temporarily taking a supply from an outside source. If this is allowed for the change in February would be +6·3%.

Concession to Large Consumers

A reduction in the cost of electricity to large industrial and commercial consumers, which it is estimated will save the 6,000 firms concerned a total of over £400,000 a year, was announced last week by the Midlands Electricity Board. From 1st April, consumers taking low or medium voltage supplies under Tariffs 6, 7 and 7(a) will pay 0·00063d instead of 0·0007d per kWh for each penny by which the fuel cost per ton charged for bulk supplies is more than 60s. For consumers taking supplies metered at more than 650 V the reduction is from 0·00065d to 0·00059d per kWh.

Announcing the concession, the chairman of the Board, Mr. W. S. Lewis, said they were passing on to consumers the benefit of a change in the bulk supply tariff which had been made possible by the increase in the thermal efficiency of the newer power stations. By the nature of their tariffs the consumers concerned had in the past been the first to bear the burden of successive increases in the cost of coal.

Procedure for Dealing with Complaints

The Southern Electricity Consultative Council, at its meeting at Reading on 17th March, considered a representation by the North Eastern District Committee to the effect that, when a Member of Parliament received a complaint from one of the Board's

consumers, he should refer it to the Consultative Council and not to the Board or to the Electricity Council. The Consultative Council considered that every opportunity should be given to the Board to settle the matter before a case was referred to the Council and the representation was not accepted.

Proposed Nuclear Power Station Site

The Central Electricity Generating Board is applying to the Minister of Power and to the local planning authority for consent to develop a site of about 175 acres at Oldbury-on-Severn for a nuclear power station. The site lies on the south-eastern bank of the Severn Estuary 14 miles north of Bristol and 4½ miles downstream from Berkeley where a nuclear power station is already under construction.

Advantage will be taken of a rock shelf off-shore to create an artificial tidal reservoir from which cooling water can be drawn during low-tide periods. This unusual arrangement will reduce the cost of obtaining cooling water from an estuary with as wide a tidal range as the Severn. Foundation conditions on shore are good for supporting heavy reactors. Present indications are that a station on this site might have a total capacity of about 1,000 MW.

Investigation of three other areas on the Severn Estuary, Tidenham, Aust and Portskewett, is continuing to determine whether they are suitable for future nuclear power station development.

Site Investigations in East Midlands

It is proposed to investigate five areas in the East Midlands to ascertain their suitability as sites for coal-fired power stations. They are at Radcliffe-on-Soar, Holme Pierrepont, Market Warsop, Cottam and West Burton. Ground surveys and trial borings will be made and it is expected that the investigations will take several months. Generating capacity will depend upon the facilities offered by the sites to be examined and may well be 1,000 MW. The East Midlands coalfield is the largest producer in this country of the low-grade coal used for electricity generation, and output is expected to increase in the future.

Contracts for Completion of Kincardine Station

The South of Scotland Electricity Board announces that the two main contracts for the completion of the Kincardine - on - Forth generating station have been placed with the General Electric Co., Ltd. (two 200 MW turbo-generators, with feed heating and condensing plant) and Babcock & Wilcox, Ltd. (two 2,400 lb/sq in boilers). The combined value of these contracts is in the region of £8 million.

The Board adds that while the main plant to be provided by the G.E.C. will be manufactured at Erith, the largest sub-contractor is G. & J. Weir, Ltd., of Cathcart, Glasgow, who will provide the feed heating and condensing plant, at a cost of over £1,000,000. In addition the greater part of the forgings, castings and steelplates will be of Scottish origin. The boilers will be manufactured at the Babcock & Wilcox works at Renfrew. The remainder of the contracts for the second half of the station will largely comprise building and civil engineering works and will amount to some £10 million. These contracts, totalling £18 million, will thus provide considerable employment in Scotland.

When completed, the Kincardine station will have an installed capacity of 760 MW and will be by far the largest generating station in Scotland. The present installed capacity of all generating plant in South Scotland is about 1,700 MW.

New Station for Irish Board

The Irish Electricity Supply Board's new hydro-electric station on the River Clady, County Donegal, which will produce 13 million kWh a year, has been completed and has begun its commissioning tests. It is equipped with a horizontal Francis type turbine coupled to a generator with a capacity of 4,000 kW.

Parliamentary Report

Electricity Bill Passed

The Electricity (Borrowing Powers) Bill had its third reading in the House of Lords without debate, and it now awaits the Royal Assent.

T.V.A. Contract

Before Mr. Macmillan left on his visit to Washington, Dame Irene White and Mr. Gerald Nabarro tabled a motion in the Commons asking him to mention to the American Government the anxiety felt by British people about the American opposition to the order recently obtained by C. A. Parsons. They pointed out in the motion that the order was obtained in open tender from the Tennessee Valley Authority and asked the Prime Minister to state that British people could not believe that any action could be contemplated by the American Government which would destroy the unity and co-operation between our two nations, a unity that was cemented by sound trade relations.

Advertising of Second-hand Appliances

Mr. Stonehouse, who recently returned from Central Africa, asked the Parliamentary Secretary, Board of Trade, when there would be a report from his Department on the misleading advertising of second-hand household equipment, including reconditioned vacuum cleaners and washing machines.

Mr. J. Rodgers said the inquiry had been completed and it produced no evidence on which criminal charges could be based. He was glad to hear, however, that the Newspaper Proprietors' Association and the Periodical Proprietors' Association had recommended their members to obtain undertakings from advertisers of mail order goods that the goods were available.

Mr. F. Noel-Baker said that the inquiry was totally inadequate. Firms about which complaints were made in the House months ago were carrying on these activities and new firms were starting to indulge in them.

Mr. Rodgers replied that there was nothing fraudulent in attempting to sell a product that was more expensive than that advertised. In matters of this kind the Board of Trade could take action under the Merchandise Marks Acts only against false and misleading descriptions. Later, in reply to a further debate on the subject, he announced that the Government proposed to set up a committee to investigate the whole question of consumer protection.

Victoria Tube

Mr. Eric Fletcher asked the Minister of Transport what advice he had received from the London Travel Committee with regard to the expedition of the plans of the London Transport Commission for constructing the proposed new underground railway from Victoria to Walthamstow.

Mr. G. R. H. Nugent, Parliamentary Secretary, said the Committee was now examining the proposal. He added that the London Transport Executive was anxious to begin but, as it was a very expensive proposition, estimated to cost between £50 million and £60 million and to lose £3 million a year, the Government had to weigh the pros and cons very carefully before deciding whether the money could be better spent on other ways of improving London's traffic system.

Commonwealth Telephone Cable

In reply to Mr. Biggs-Davison, Mr. Thompson, Assistant Postmaster General, said that in approving the construction of a Commonwealth round-the-world telephone cable system the Montreal Conference recognised that the Commonwealth Governments would need to make further detailed studies of the plan before entering into binding commitments. The United Kingdom attached great importance to the achievement of this imaginative project, and would be glad to play a full part in its development. The first stage would be the completion in 1961 of a new telephone cable between Canada and the United Kingdom. The contract for the first section of this cable had been let by Cable & Wireless, Ltd.

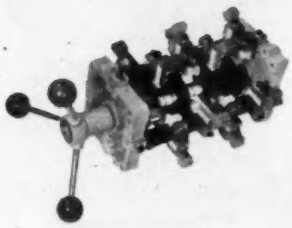
NEW ELECTRICAL EQUIPMENT

Multi-Circuit A.C. Switch

A new slow-make-and-break on-load switch has been added to the range of multi-circuit switches covering from 15 to 150 A manufactured by AUSTINLITE, LTD., 28, St. James's Square, S.W.1, a member of the Stone-Platt group.

The moving contacts are rollers bridging pairs of fixed contacts, enabling the switches to withstand transient overloads without deterioration, and the fixed contacts have silver contact faces $\frac{1}{16}$in thick. For off-load duties the switch is rated at 300 A per moving contact. Contacts are open to visual inspection and can be removed for servicing without dismantling the switch.

The fixed contacts can be mounted at any point on the bar so that creep distances can be increased for high voltage applications. An A15, A30 or A50 switch can be mounted in tandem for switching auxiliary circuits.



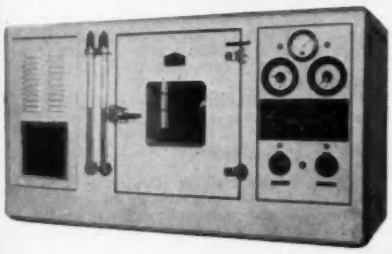
Austinlite rotary switch

Controlled Humidity Cabinet

A humidity cabinet equipped with a refrigeration plant permitting low temperature testing is announced by HEDIN, LTD., Commerce Estate, South Woodford, London, E.18. The unit capacity allows temperatures of −10 deg C to be obtained in an ambient of 20 deg C. Automatic temperature control is provided by an adjustable thermostat and an electrically driven, hermetically sealed compressor circulates Freon 12 refrigerant.

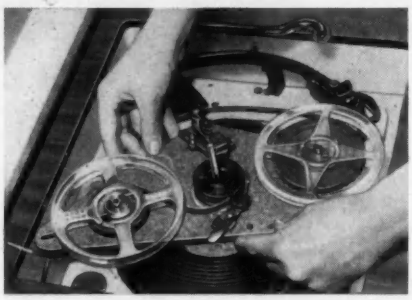
Construction is of stainless steel and aluminium with electro-plated brass fittings, and 2in thick glass fibre ensures high thermal stability. A fan unit provides an ample air flow through the humidity chamber giving a maximum temperature gradient of ±1 deg C throughout the working space. All the controls are mounted on the front of the cabinet, and timers can be fitted to provide automatic control at predetermined conditions.

Hedin humidity cabinet



Tape Recorder

A tape recorder which can be driven from an ordinary gramophone turntable is being made for ANDREW MERRYFIELD, LTD., 29-31, Wright's Lane, London, W.8, who are the world concessionaires. The "Gramdeck" gramophone adaptor, made in Britain, offers recording, play-back and magnetic erasure of standard tape, but obtains its power from the gramophone turntable.



"Gramdeck" tape recorder for attachment to a gramophone turntable (Andrew Merryfield, Ltd.)

The body of the unit is supported by a small locating pillar, which has to be fixed to the gramophone motor board. This support prevents the gramophone from rotating and does not introduce "wow." A transistor pre-amplifier/control unit is provided as part of the "Gramdeck" equipment and can be used for recording from microphone, pick-up or radio.

The maximum torque required by the tape recorder is 160 gm cm and most record player motors will comfortably provide about 300 gm cm with no more than 1 per cent speed change. In an average installation the response is about ±3 dB over the range 60 to 10,000 c/s. The "Gramdeck" costs £13 12s, including the transistor battery.

Immersion Heater Circulators

A new range of immersion heater circulators, with loadings from 12 to 108 kW, has been introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. They are designed for both direct and indirect central heating systems in schools, public premises, churches, etc. The circulators are of all-welded construction and manufactured from heavy gauge steel finished in grey stoved enamel. Heavy duty sheathed wire immersers are fitted, together with 18in adjustable rod type thermostats scaled 110/190 deg F. A sheet metal cover encloses the electrical equipment and terminal blocks and the wiring is arranged for connection to a 3-phase, three or four wire system through separate contactors. A safety valve and drain cock are supplied and a ½in female connection is provided for a thermometer where required.

G.E.C. 72 kW immersion heater circulator

Control panels comprising contactors, fuses and pilot lights are available for the 48 kW to 108 kW sizes. Accessories include lagging jackets for the 12 kW to 72 kW sizes; lagging on site is recommended for the 84 kW to 108 kW sizes. The prices range from £60 (12 kW) to £193 (108 kW).

Rotary Ironer

A new rotary ironer now available from MORPHY-RICHARDS, LTD., 50, Conduit Street, London, W.1, weighs 34 lb (6 lb less than the company's

Morphy-Richards new rotary ironer

previous model) and is also fitted with a foot control to increase the speed and ease of operation, thus leaving both hands free to guide the ironing work through the machine.

The roller measures 22in long and has a diameter of 5in. It is quilted to protect buttons and trimmings, and the chromium plated ironing shoe is bevelled to prevent edges catching. It is thermostatically controlled and has a variable heat switch. There is also a control for free-wheeling the roller and an extra motor switch for the stationary pressing of small articles —folded handkerchiefs, collars and cuffs, etc.

The ironer is finished in stove enamelled cream and measures 32in long by 14in wide by 11½in high. The loading is 1,100 W and it is available in four voltage ranges—100/120, 120/130, 200/220, 230/250 V (a.c. only). The price is £27 15s plus £6 0s 2d purchase tax.

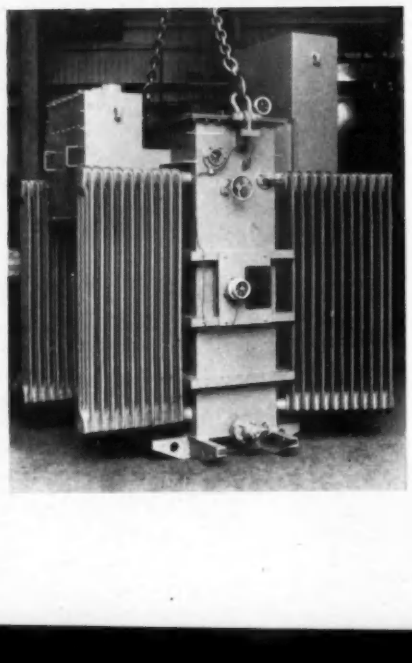
Soldering Machine

The Mark V Flowsolder machine, introduced by FRY'S METAL FOUNDRIES, Tandem Works, Merton Abbey, London, S.W.19, provides completely automatic soldering of printed circuit boards. The boards are automatically fluxed, carried over infra-red heaters and passed over the molten solder wave. Control is from a central panel, and the whole machine can be supplied with a support frame on castors, for easy movement.

Cooling Radiators

Steel radiators with couplings for direct welding to the tank wall of oil-cooled equipment without inserting valves have been announced by WASHINGTON ENGINEERING, LTD., P.O. Box No. 4, Washington, Co. Durham. A large connecting header at the top and bottom of the radiator units supplies sufficient oil to all sections without obstructing the movement of the rising air on the outer radiator surface. The upper connection of the radiators can be positioned near the top edge of the tank side as no flanges and flange pads are required, enabling the hottest oil to be circulated through the radiators.

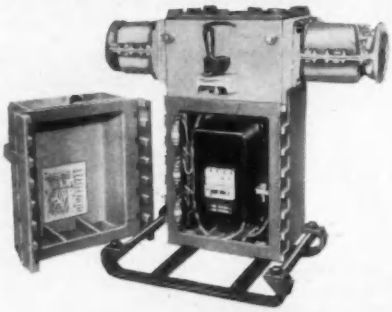
Washington radiators welded to a 1,000 kVA Hackbridge transformer tank



For use with small regulator, transformer and rectifier tanks, the radiator type "Trafo 858" has been developed, available with distances between centres covering a range from 12 to 55in. Larger radiators, type "Trafo 9," with centres from 42 to 144in can also be supplied.

Flameproof Metering Panel

The flameproof metering panel type BMP-9 has been introduced by SIEMENS-SCHUCKERT (GREAT BRITAIN), LTD., Faraday Works, Great West Road, Brentford, Middlesex, to facilitate meter readings in such situations as coal mines where a record of the electricity consumed by individual flameproof machines is required.



Siemens-Schuckert metering panel

The panel comprises a flameproof tank with two separate flameproof chambers, the upper having three busbars rated at 300 A, with current transformers and an isolating switch, and the lower having a three-phase, three-wire, unbalanced load, two-element, integrating standard industrial pattern watthour meter, with fuses.

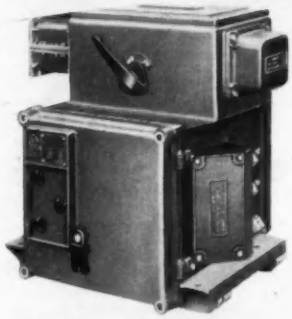
The front cover of the tank, which is interlocked with the isolator, is of the single-lock type and it is necessary only to turn a single screw for cover removal or replacement. As the unit is intended for use near the coal face and in other dusty situations, no window is provided; only a minute or two is required for removing the cover, reading the meter and replacing the cover. The busbar flange dimensions of the panel are as specified for standard gate-end panels and, by using flit-plug adaptors, it can be inserted in the main cable run at any required point. The metering panel, which is suitable for circuits up to 650 V, has been certified flameproof.

Flameproof Lighting Transformer

The type SLU lighting transformer unit recently added to the range of flameproof equipment designed to N.C.B. specification and manufactured by the BELMOS CO., LTD., Bellshill, Lanarkshire, is certified for Group 1 gases. The single-phase transformer has a continuous rating of 4·5 kVA with tappings on the primary winding to accept a supply between 400 and 650 V. The secondary windings can be connected by links either in parallel to give 115 or 125 V or in series to give 230 or 250 V, and by means of further links one 40 A circuit or three 13 A lighting circuits can be supplied at 115/125 V, or one 20 A or three 6 A circuits at 230/250 V. H.r.c. fuse-links protect each of the outgoing circuits.

A miniature circuit-breaker mounted at the front of the chassis provides earth leakage protection at all voltages, tripping at fault currents in excess of 2 A. There is a combined test/reset knob on the front cover.

The housing consists of a welded steel case divided horizontally into two flameproof compartments. The upper compartment houses the 300 A busbars and a two-pole isolating switch, the lower houses the transformer and protective equipment mounted in a chassis which can be withdrawn on slide rails. All electrical connections between the chassis and the enclosure are made by spring-loaded butt contacts and an interlock bar prevents the main cover being closed until the chassis is fully racked in.



Belmos flameproof transformer

CATALOGUES AND LISTS

TELEPHONE EQUIPMENT. — Leaflet dealing with intercommunication telephone systems and a brochure describing a telephone dictation recorder to enable correspondence to be dictated over the normal extension telephones of a private automatic system.—**Communication Systems, Ltd.**, Norfolk House, Norfolk Street, London, W.C.2.

VARIABLE SPEED GEARS.—29-page illustrated catalogue dealing with the range of "Kopp" variable speed gears.—**Allspeeds, Ltd.**, Oakenshaw Works, Clayton-le-Moors, Accrington, Lancs.

WELDING EQUIPMENT.—Leaflet (7) describing the company's 3-phase system of resistance welding.—**Sciaky Electric Welding Machines, Ltd.**, Falmouth Road, Slough, Bucks.

Leaflet (WA/141) giving data on "Hermees" welding electrodes for fast welding of heavy sections and restrained joints.—**English Electric Co., Ltd.**, Queens House, Kingsway, London, W.C.2.

Financial Section

STOCKS and SHARES

ENGLISH ELECTRIC £1 shares have been well supported since the appearance of the 1958 financial results, which produced a widening of the margin between earnings and the 14 per cent dividend, and they remained firm at around 64s 9d after Sir George Nelson's review at the annual meeting. From general points of view his emphasis on the importance of stabilising or reducing costs, and on the problems arising from the intensity of competition, has been widely discussed. On the subject of profit margins he pointed out that an increase of £14 million in the English Electric group's turnover during 1958 resulted in an improvement of only about £800,000 in the trading profit. To illustrate the point further, he gave an analysis of every £100 received, showing that about £49 was accounted for by materials, £32 by wages and salaries and £15 by depreciation and interest. Of what was left, taxation took a little over £1¼ and the dividends less than £1, leaving under £1¾ for retention in the business. A 50 per cent scrip issue is to be distributed to ordinary shareholders on the register at 30th April next.

Ultra Electric Acquisition

There has been activity in Ultra Electric (Holdings) 5s shares, and a rise in the price to 14s, since the announcement of the operating company's acquisition of the issued capital of Pilot Radio, and at the same time the "Pilot" trade marks in seventeen European countries from the Pilot Radio Corporation of America. The Holding Company's financial year ends this March, and the results may be expected to appear in June. A year ago the report showed a very sharp recovery from a previous setback, and the restoration of the dividend to 15 per cent. An interim payment of 5 per cent was made on account of the latest period. According to the chairman's last review, the activities of the group's Special Products Division had grown to be larger than those of the older business in radio and television, and their future possibilities were described as large and challenging. On the last dividend rate the yield on the shares works out at close on 5½ per cent. The non-voting "A" shares stand 1s below the price of the ordinary.

Ada (Halifax)

The 1s shares of Ada (Halifax) are now quoted ex the rights issue of three million new shares at 1s 9d, to existing holders, in the ratio of three for eight. The new shares have been changing hands at a premium of about 1s 3d. During the past year, the company has spent £30,000 on acquiring a new factory for the production of refrigerators and £120,000 on preparing it for production, which is expected to start in the near future and to begin contributing to profits in the period 1959-60. Future plans include extensions to the main works at an estimated cost, including equipment, of £250,000 with the object of increasing output, particularly of washing machines. For the year ending this month the directors expect profits to work out at about £300,000 before tax, on which basis they intend to pay a final dividend of 15 per cent on the increased capital. An interim dividend of 10 per cent was paid in December, following distributions totalling 17½ per cent for 1957-58. The board anticipates greater success in the year to come and would feel justified in maintaining the dividend at 25 per cent in the coming year if profits remained at the estimated current level. There is thus a prospective yield of 8¼ per cent on the new shares at an all-in price of 3s (free of transfer stamp).

Dividends Increased

Switchgear & Cowans 5s shares hardened to 12s 6d after the declaration of the final dividend, which makes a total of 15 per cent for the year, against last year's equivalent of 11¼ per cent. Trading profits, at £282,000, expanded by some 13 per cent and the net surplus of £72,000 (after tax) covers the net amount of the distribution nearly twice over, on the basis of which the shares now show a yield of 6 per cent. Over twelve months, and taking into account the 100 per cent scrip issue, the value of the shares has more than doubled. Higher profits and a larger dividend are reported also by Enfield Rolling Mills who are bringing their payment for 1958 to a total of 15 (against 12½) per cent from earnings equal to about 30 per cent on the ordinary capital. At 47s 6d the £1 shares offer a yield of over 6¼ per cent.

R. B. Pullin

Earnings of R. B. Pullin, whose annual meeting was held recently, further expanded during the year ended last September to £358,000. In addition to the maintenance of the dividend at 20 per cent there is an additional 5 per cent in the form of an interim payment for the current year. This will not be taken into account when dividends for 1958-59 are under consideration. The total of 25 per cent is covered more than twice by profits available. In his review accompanying the annual report, the chairman told shareholders that the order book had been kept at a very satisfactory level and that the plant was fully occupied. They were meeting with success in developing commercial business outside the field of Government work. He spoke of increasing difficulty in securing adequate profit margins but felt confident of the company's ability to continue to earn the profits necessary to provide for satisfactory dividends and judicious additions to reserves. Quoted at 10s 3d, the 2s shares of the company give a yield of a fraction under 5 per cent on the basis of a 25 per cent distribution.

Cable & Wireless

A fourth quarterly dividend of 2½ per cent from Cable & Wireless (Holding), which has lately held its annual meeting, brought the total for 1958 to 10 per cent. This was the same rate as for the previous year, but it applied to capital increased by a free one-for-ten share issue and, so far as the last three quarters were concerned, by a one-for-five cash issue to which holders had the opportunity to subscribe at a price of 5s per share. The shareholders' return was, in fact, raised by some £87,000 net, which was about equal to the increase reported in the company's revenue for the year at £742,000, after a larger tax charge. A yield of not much over 3½ per cent on the 5s shares at 14s testifies to their popularity with the investor who likes his capital to cover a great range of interests under expert management. According to the latest balance sheet, the company held quoted investments having a market value of over £25 million, apart from important unquoted interests.

Other Trusts

Like Cable & Wireless (Holding), the Globe Telegraph & Trust Co. made both scrip and cash issues last year and expected to be able to maintain the dividend, on the capital so increased, at the same rate of 10 per cent as before. The interim for the current year, which ends in June, was duly repeated at the previous rate. The final will be expected in July. Although not as large as Cable & Wireless, the company showed in its last balance sheet quoted investments having a market value of over £17 million, so that here also investment in the shares is very broadly based. At 13s 3d they give a prospective return of 3¾ per cent. A return of 4 per cent is shown by Atlas Electric & General Trust £1 shares at 60s, assuming that in this case also the rate of the dividend will be maintained at 12 per cent after a scrip issue. The final declaration is due in May. This Trust's quoted investments were valued at £16 million in March last year.

Because of printing arrangements for the Easter holiday we are unable to publish our usual table "Price Changes in Electrical Investments." It will appear again on 10th April

REPORTS and DIVIDENDS

English Electric Co., Ltd.—The annual meeting was held on 19th March, Sir George H. Nelson, Bt. (chairman), presiding. In presenting the report and accounts for the year ended 27th December last (*Electrical Review*, 20th February), Sir George welcomed back Mr. H. G. Nelson (managing director) from his tour of India. Mr. Nelson was much impressed with the possibilities and felt strongly that the company should collaborate as closely as possible with the development of that country.

Turning to the accounts, Sir George said that for 1958 turnover of the group, including the overseas subsidiaries, was £162 million, as compared with £148 million in 1957. This increase of £14 million had brought an additional trading profit of only approximately £800,000.

Referring to some of the more significant developments during the past year, Sir George said that in 1958 they greatly expanded the scale of their design, research and development effort in the atomic field in which they were collaborating with Babcock & Wilcox and Taylor Woodrow. They had provided the latest large-scale electronic computer equipment. Their expenditure on atomic development was very substantial and he must emphasise that the load thrown on the shoulders of private enterprise to cover this field of development was on a vast scale which must be recovered within a reasonable time in the prices obtained for atomic power plant contracts. To deal with the order for Hinkley Point power station they had formed a joint company known as the English Electric, Babcock & Wilcox and Taylor Woodrow Atomic Power Construction Co., of which Mr. E. M. Price, the general manager of their Rugby works and of their Atomic Power Division, was managing director.

At the end of last year there were steam turbines of their manufacture totalling over 15 million h.p. commissioned or on order and water turbines of over 11 million h.p. One example in this field was the work which had been proceeding during the year on the 200 MW sets for the 1,000 MW power station at High Marnham. The first turbine had now been completed at the company's works at Rugby and commissioning on site was planned for later this year. These sets were the largest yet manufactured for any power station in Europe and were also the largest tandem sets yet made by any manufacturer in this country.

In the traction field, over the years they had carried out extensive research and development at their own cost. The development of the Deltic diesel-electric locomotive had been an outstanding example which resulted in the receipt of an order from British Railways for twenty-two of these locomotives to operate on the East Coast route to Scotland. Other examples had been the development of a new type of bogie for electric trains, which had greatly reduced the need for lubrication and replacement or adjustment, and the development in the earlier days of their diesel-electric shunting locomotive. They were now producing 2,500 h.p. locomotives weighing only 80 tons, as compared with three electric locomotives each of 1,470 h.p. weighing 101 tons built some years ago for the Southern Railway.

After referring to the activities of the Aviation Division, Sir George turned to the export position. He referred to the difficulties which existed due to intense competition from the exporting nations of the world, and said that the English Electric group had endeavoured to play its part by expanding its interests and by diversifying its products. In the year under review they had completed a new factory in India, while in Spain they had been very active since the war in the fields of power generation, steel works, and railway electrification. During the current year they had formed a Spanish company—English Electric Espanola. It was the policy, as and when developing business warranted, to form offshoots of the parent company in overseas territories, so that nationals of these countries on the boards or in the employment of the local companies could play an increasing part in the development of their own affairs.

Their future success depended largely upon the extent to which they could stabilise and if possible reduce their costs. There were many important overseas manufacturers and suppliers of capital equipment who were active in world markets, and their number was growing as one country after another established an electrical engineering industry. At the same time, during the past few years the severe fall in world commodity prices, while it had brought a welcome improvement for the time being in terms of trade and therefore the balance of payments of the United Kingdom, had reduced the ability of many of their customers, who had low exchange resources and inadequate finance for development, to buy capital equipment here. The result had been that the question of prices had become an increasingly important consideration to these customers and competition therefore had become even more severe. Competition for its own sake or pushed to extremes could cease to be beneficial to this country and in fact could become positively detrimental. Indeed a position could be reached where the standards of all countries of the world who produced the technical products in which they were interested would be adversely affected by artificially debased prices.

They, in their company, were pursuing every means of increasing productivity—they looked to continued research and development, to design improvement, still better manufacturing methods, and fuller utilisation of machine time to meet the needs of the future.

Speaking of overseas trade prospects, Sir George said that there was a general climate of expansion which had admittedly been hampered by a world shortage of capital. At the Montreal Conference United Kingdom Ministers announced new and improved methods of lending, which should be of great assistance to the development of power, transport and communications in vital Commonwealth markets. There were also in prospect big increases in the resources of the World Bank and the International Monetary Fund. If these projects came to fruition it would enable developing countries throughout the world to finance an ever-growing volume of trade and to plan their development on a more secure basis.

After referring to the group's education and training schemes, Sir George briefly reviewed the activities of the other major companies within the group.

Marconi's Wireless Telegraph Co., Ltd.—In the course of his speech at the annual meeting held on 19th March, Sir George Nelson, Bt. (chairman), said that during the year under review progress had been well maintained in every branch of their activities, and in particular, despite certain adverse factors, their exports had reached a record level.

Their research could be divided into two broad categories—basic, or long-term research, and applied research. In the field of applied research they were actively engaged in the development of a comprehensive system of air traffic control incorporating complex link and data handling equipment to deal with the ever-increasing flow of air traffic. A major contribution to safety in the air lanes through the control of air traffic had been made by the introduction of their new high-power 50 cm radar originally developed at the Baddow laboratories. Research and development into television and sound broadcasting continued to bear fruit. Studies in semiconductors had continued and the laboratory group devoted to this work was now also charged with the responsibility of executing a research programme on behalf of Associated Transistors, Ltd., which was jointly operated by a consortium consisting of the Automatic Telephone & Electric Co., Ericssons and the English Electric Co. which had been set up to meet the transistor requirements of these three companies.

With the development of new microwave and radar techniques, a field of research which had assumed steadily greater importance in recent

years was mechanical engineering. There were now many aspects of radio engineering where great precision was vital, such as large rotating radar aerial systems. One result of these studies was their decision to absorb their subsidiary, Scanners, Ltd., into the Marconi Company. The former Scanners works would now be known as Marconi's Felling Works, where they would undertake work which was predominantly mechanical in nature.

The value of orders received by the Aeronautical Division during 1958 compared well with that for the previous year and included substantial orders from overseas in spite of increasing competition. In the past ten years the company had completed nearly seventy major defence radar installations and had supplied radar equipment, both military and civil, to nearly thirty different countries.

Demand for sound broadcasting equipment continued at a satisfactory level, especially from overseas, and the value of orders for television equipment received by the Broadcasting Division during the year was the highest in its history in spite of a marked increase in competition both at home and abroad. A notable event during 1958 was the delivery to the Smith Kline & French laboratories of the first complete mobile medical colour television unit to be made in this country.

The Communications Division had had a successful year, particularly in the sale of v.h.f. and microwave multichannel radio link equipment. To date, they had v.h.f. and microwave multichannel link installations completed or in hand for systems having a route mileage of 10,000 miles in thirty-five overseas territories.

Marconi Instruments, Ltd., had had another satisfactory year and its turnover reached a record level. Most of this increase was due to a considerable rise in export orders, a high proportion of which was again to the dollar countries.

The number of apprentices of all grades under training with the company continued to increase year by year.

Marconi International Marine Communication Co., Ltd.—In his address at the annual meeting held on 19th March, Sir George Nelson, Bt. (chairman), said that throughout 1958 the shipping industry had been going through a period of recession, which had adversely affected their business and checked their progress. The beginnings of a trade revival now being experienced would benefit the shipping industry and through it the business of the company.

The "Nautilus" frequency-modulated v.h.f. equipment, used for the radiotelephone conversation between Lord Simon and the Postmaster General at the inauguration of the new v.h.f. facilities at North Foreland Radio, had proved a useful addition to their range of products. Substantial orders for this equipment had already been placed. They were pressing forward with the development and production of new equipments. Their latest radar, with track indicator, and much communications and other equipment, had been supplied to the Union Castle Line's new passenger liner *Pendennis Castle*, and the *Windsor Castle*, now building, would have a Marconi Marine installation similar to that of the *Pendennis Castle*.

In the field of radar they had now turned their attention to satisfying a demand for small, simple radar sets at a suitable price for small vessels. Design work on such a radar had now been completed and tests had been carried out during the past twelve months on board their research vessel *Elettra II*. Sets were now becoming available and would be in full production during the course of this year. Sir George referred to the success of the "Graphette" and "Fishgraph" echometers for the fishing fleet.

They continued to expand their service facilities as the development of trade in specific areas demanded it.

Veritys, Ltd.—In the Chancery Division on 16th March Mr. Justice Roxburgh made no order for the compulsory winding up of Veritys, Ltd., and he discharged the appointment of the provisional liquidator and referred to Chambers the assessment of the costs, charges, expenses and remuneration of the provisional liquidator and of the Official Receiver.

Mr. R. Instone, for the Midland Bank, said that since the petition was last before the court the company had been placed in a creditors' voluntary winding-up and a scheme had been approved designed to secure for the bank and any other preferential creditor the same degree of preference as they would be entitled to in a compulsory liquidation.

A. H. Hunt (Capacitors), Ltd.—The group profit for 1958 amounts to £263,631, as compared with £194,344 for 1957. Taxation absorbs £137,530 and the net balance is £126,101 (against £89,158). Reserves receive £83,000 and it is proposed to pay a final dividend of 11½ per cent (against 10 per cent), making 15 per cent (13¾ per cent) for the year. The balance carried forward by the parent company is £49,931 (against £45,551 brought in).

Enfield Rolling Mills, Ltd.—The consolidated trading profit for 1958 was £1,879,567 and compares with £1,749,990 for 1957. After deducting £810,000 for taxation, and £199,873 for depreciation, the net balance is £737,725 (against £632,750). It is proposed to pay a final dividend of 12½ per cent (against 10 per cent), making 15 per cent (12½ per cent) for the year.

Switchgear & Cowans, Ltd., reports a trading profit for the year ended 31st December last of £282,384, as compared with £212,669 for the preceding year, and after providing £112,950 for taxation, the net profit is £71,554 (against £46,754). It is proposed to pay a final dividend of 10 per cent (against 15 per cent) on doubled capital, making 20 per cent for the year. The interim dividend was paid on the smaller capital. For the previous year the distribution was 22½ per cent.

N.V. Philips Gloeilampenfabrieken.—In 1958 the total sales of the Philips organisation, including all the foreign subsidiaries, increased by 13 per cent from f.3,177 million in 1957 to f.3,595 million. The trading profit rose by 26 per cent from f.442 million to f.557 million, and the net profit by 30 per cent from f.187 million to f.244 million. The dividend remains unchanged at 14 per cent on the ordinary and 7·6 per cent on the preference shares. Of the total share capital 15 per cent is held in the United States, 15 per cent in France, 9 per cent in Britain, 8 per cent in other foreign countries and 53 per cent in Holland. The total number of employees at the end of the year was 174,000 (an increase of 14,000 over 1957); 64,000 of these were in Holland.

Truvox, Ltd., informs us that the activities of the company are in no way affected by the members' winding-up of Truvox Holdings, Ltd., which is a non-operative company in the Truvox Group and has been liquidated for purely administrative reasons.

James Howden & Co., Ltd., have declared an interim dividend of 5 per cent (unchanged).

Courtney, Pope (Electrical), Ltd., is paying an interim dividend of 10 per cent (unchanged).

New Companies

Spincraft, Ltd.—Registered 13th March. Capital £1,000. Electrical and general engineers, manufacturers of and dealers in dynamos, armatures, etc. Directors: L. R. Boulton and Pauline M. Boulton. Regd. office: 46, High Street, Poole.

Glowburn Fires, Ltd.—Registered 16th March. Capital £2,000. Manufacturers of and dealers in electric fires and electrical goods of all kinds, etc. Directors: H. F. Hewston and T. H. Moore. Solicitors: G. F. Pearson, Rowe & Co., Birmingham, 3.

Farley Paine, Ltd.—Registered 16th March. Capital £5,000. Electrical engineers and contractors, etc. Directors: H. F. Paine and Maud Farley Paine. Regd. office: 4, Castle Hill Road, Hastings.

Wilson & Gardner (Portsmouth), Ltd.—Registered 9th March. Capital £100. Ventilation, refrigeration and electrical engineers, manufacturers of and dealers in refrigeration and cold storage equipment, etc. Directors: G. W. Gardner and J. C. Wilson. Regd. office: 232, Somers Road, Portsmouth.

Industrial Humidifiers, Ltd.—Registered 26th February. Capital £1,000. Manufacturers of and dealers in electrical apparatus, including humidifiers, air conditioning plant, etc. J. Lipton is the first director. Regd. office: Queens House, Leicester Square, W.C.2.

Robert Harris & Co. (Saltcoats), Ltd.—Registered in Edinburgh 5th February. Capital £30,000. Electrical, radio, television, motor, mechanical and general engineers, etc. Regd. office: 18-20, Green Street, Saltcoats.

Westcombe Electric & T.V. Co., Ltd.—Registered 2nd March. Capital £100. Manu-

New Companies—*continued*

facturers of and dealers in and repairers of electrical goods, etc. Directors: K. Cline and Mrs. Barbara M. Cline. Regd. office: 76, Harehills Road, Leeds, 8.

H. W. Small (Electrical), Ltd.—Registered 27th February. Capital £1,000. To acquire the business of an electrical heating installation contractor now carried on by H. W. Small, of 93, Bury Green Road, Cheshunt. Directors: H. W. Small and Mrs. Betty E. Small. Regd. office: 100, Fore Street, Hertford, Herts.

J. F. Humble, Ltd.—Registered 27th February. Capital £5,000. Manufacturers, exporters and importers of and dealers in and agents for radio, television and electrical apparatus and appliances, etc. Directors: J. F. Humble and Mrs. Annie Humble. Regd. office: Front Street, Wolsingham, Co. Durham.

Electronic Products (Cardiff), Ltd.—Registered 2nd March. Capital £1,000. Manufacturers of and dealers in electronic, radio and television equipment, etc. Directors: M. Glick and D. Glick. Regd. office: 47, Westgate Street, Cardiff.

Osmor Transformers, Ltd. — Registered 27th February. Capital £100. Designers, manufacturers of and dealers in electrical transformers and voltage regulating equipment, etc. Directors: L. Kanner, A. C. Kanner and A. V. Lake. Regd. office: 11, New Court, Lincolns Inn, W.C.2.

Fieldsman Enterprises (Mansfield), Ltd.—Registered 4th March. Capital £1,000. Wholesale and retail distributors and manufacturers of television, radio and electrical equipment, etc. Directors: E. A. Wharmby and J. R. Gregory. Regd. office: 54, Nottingham Road, Mansfield.

Industrial Switchgear, Ltd.—Registered 4th March. Capital £2,000. Manufacturers of and dealers in electrical and magnetic switchgear and control gear and fittings of all kinds, etc. Directors: J. F. Cordwell and C. F. Walker. Regd. office: 28, Station Road, Birmingham, 27.

Electrical and Telephone Installations, Ltd.—Registered 4th March. Capital £100. To acquire the telephonic and telegraphic business of H. Bridges carried on by H. Bridges, D. V. Parsons and D. E. A. Organ at 27, Mayfield Road, Streetly, Staffs. Directors: H. Bridges, D. E. A. Organ and D. V. Parsons. Regd. office: 27, Mayfield Road, Streetly, Staffs.

Liquidations

Easipower, Ltd.—Winding-up voluntarily. Liquidators, Mr. K. R. Cork, 19, Eastcheap, London, E.C.3, and Mr. H. W. Pitt, 100, Park Street, London, W.1, appointed 25th February. Particulars of claims by 10th April to Mr. Cork.

Easipower, Ltd., has now been reconstructed and refinanced. The company joined the Pena Industries Group at the end of 1956, but because of the liquidation of Pena Industries last year, it has been necessary to reconstruct it. The undertaking and trade of Easipower, Ltd., and all the working assets have been purchased by a new company to be known as Frederick Williams (Appliances), Ltd., which will carry on the manufacturing activities previously undertaken by Easipower, Ltd. The directors of the new company are Messrs. C. M. Bell, A. A. Christy, R. L. Eastwood, D. T. Papillon, S. E. Prior and F. R. Williams (managing). The subsidiaries, Easipower Service, Ltd., and Easipower Appliances, Ltd., have been purchased by Frederick Williams (Appliances), Ltd., and will carry on as before.

Deakins (Electricians), Ltd.— Particulars of claims by 28th March to Mr. J. Hutton Lloyd, liquidator, 10, Ashfield Road, High Street, Cheadle, Cheshire.

F. J. Coleman (Electrical Contractors), Ltd.—Meeting 13th April at Bank Chambers, 1, John Street, Bedford Row, London, W.C.1, to receive an account of the winding-up by the liquidator, Mr. N. Osborne.

Bankruptcies

G. F. Hedger, 80, Grenville Road, Plymouth, trading as Hedger and Greenway, electrical contractor.—Last day for receiving proofs for dividend today (Friday). Trustee, Mr. J. E. Ellis, 50, The Terrace, Torquay.

G. Moore, lately carrying on business as the Electric Meter Co., at 123, Hele Road, Torquay, and 2, Barnhill Road, Torquay, electrical engineer.—Trustee, Mr. J. E. Ellis, 50, The Terrace, Torquay, released 9th February.

A. R. Hunt, trading as Hunt Brothers at 68, Thornaby Road, Thornaby-on-Tees, radio and electrical engineer.—First and final dividend of 9s 6d in the £, payable at the Official Receiver's Office, 4, Bridge Road, Stockton-on-Tees.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

TUESDAY, 31st MARCH

Coventry.—I.E.E. South Midland Graduate and Student Section. "The Electronic Organ," by J. A. Naylor.

WEDNESDAY, 1st APRIL

Birmingham.—James Watt Institute, Great Charles Street, 7 p.m. Junior Institution of Engineers, Midland Section. "Inspiration and Integration," by W. M. Larke.

Edinburgh.—Y.M.C.A., 14, South St. Andrew Street, 6.30 p.m. I.E.S. Edinburgh Centre. Annual general meeting.

Halifax.—Crown Hotel, Horton Street, 7.45 p.m. A.S.E.E. Halifax Branch. "Lesser-known Regulations in the 13th Edition of the I.E.E. Regulations," by E. Smith.

London.—Savoy Place, 6.30 p.m. I.E.E. London Graduate and Student Section. "Discriminators (F.M. Detectors) with particular reference to the Bond Disc," by S. J. Read.

Manchester.—Engineers' Club, Albert Square, 7 p.m. A.S.E.E. Manchester Branch. "Modern Trends in Lighting for Commercial and Industrial Buildings," by A. Wilcock.

Middlesbrough.—Cleveland Scientific and Technical Institute, Corporation Road, 6.30 p.m. I.E.E. Tees-side Sub-Centre. Annual general meeting followed by "Electrification of the U.K.A.E. Industrial Group Factories," by J. W. Binns and W. J. Outram.

Preston.—R.A.F.A. Club, East View, 7.30 p.m. A.S.E.E. Preston Branch. "Electrical Cable Problems," by K. Leyland.

Sheffield.—The University, St. George's Square, 7 p.m. Society of Instrument Technology, South Yorkshire Section. Annual general meeting followed by "Instrumentation and Automatic Control at I.C.I. Billingham," by C. H. Gregory.

Stoke-on-Trent. — North Staffordshire Technical College, 7.45 p.m. I.E.E. North Staffordshire Graduate and Student Section. "Magnetic Amplifiers," by G. L. Horrobin and A. D. Hawkins.

Wood Green.—Town Hall, 7.45 p.m. A.S.E.E. North London Branch. "Space Travel," by J. P. Flitcroft.

THURSDAY, 2nd APRIL

London.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Discussion on "Women in Engineering," opened by Sir Willis Jackson.

Malvern.—Winter Gardens, 7 p.m. British Institution of Radio Engineers, South Midlands Section. "A Simple High-quality F.M. Broadcast Receiver employing a Pulse-rate Discriminator," by P. J. Baxandall.

Manchester.—Reynolds Hall, College of Technology, Sackville Street, 6.30 p.m. British Institution of Radio Engineers, North Western Section. "Principles of Transistor Circuitry," by B. R. A. Bettridge.

Southampton.—Polygon Hotel, 8 p.m. A.S.E.E. Southampton Branch. "Television Practices," by P. A. Force.

THURSDAY, 2nd APRIL to SUNDAY, 5th APRIL

London.—Russell Hotel, W.C. Audio Fair.

FRIDAY, 3rd APRIL

Bath.—Royal York Hotel, 8 p.m. A.S.E.E. Bristol and West of England Branch. "The Work of the National Inspection Council."

Bournemouth.—Grand Hotel, Firvale Road, 7.30 p.m. A.S.E.E. Bournemouth Branch. Annual dinner.

Bristol.—Grand Hotel, 7 for 7.30 p.m. I.E.E. Western Centre. Annual dinner and dance.

Fawley.—Copthorne House, Society of Instrument Technology, Fawley Section. Annual general meeting followed by film show.

Liverpool.—M.A.N.W.E.B., Paradise Street, 7.30 p.m. A.S.E.E. Liverpool and District Branch. "Revision of British Standards and the Effect on Electric Motor Performances," by F. T. Bartho.

London.—Pepys House, 14, Rochester Row, Westminster, S.W.1, 7 p.m. Junior Institution of Engineers. Film evening.

Southampton.—The Polygon Hotel, 7.30 p.m. for 8 p.m. Institution of Production Engineers, Southern Region. Dinner and dance.

Street Lighting Notes

In 1957 the **Guernsey** States Board of Administration decided to renew the lighting along the quays and esplanades at St. Peter Port and G.E.C. type Z8387 AB "Three Eighty" fluorescent lanterns with tapered "Perspex" bowls were chosen. Sixty-nine lanterns are now installed, mounted on G.E.C. "Altus" concrete columns the brackets of which have a dihedral of 12½ deg. giving the units a contemporary appearance. The installation was planned by G.E.C. street lighting engineers in co-operation with the States of Guernsey Electricity Board. The Constables of St. Sampson have also approved a further fluorescent lighting scheme involving the provision of an additional 54 units of the same type.

Great Yarmouth Corporation has ordered 86 more "Kuwait" type lanterns from Siemens Edison Swan, Ltd., for extension of the promenade lighting. A total of 104 twin lanterns were installed 18 months ago. The columns for these lanterns provide for festoon lighting in the holiday season.

Sodium lighting is to be installed in High Street, **Jarrow.**

Leamington Spa Highways and Planning Committee proposes to draw up a three-year plan for the extension of Class "A" street lighting.

Tynemouth Town Council has approved a proposal to spend £2,100 on converting lighting in certain streets from tungsten lamps to sodium lamps.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1953

36044. Cosmocord, Ltd., and Kelly, S.—Electro-mechanical transducers. 25th March, 1955. (810971.)

1954

10412. Postmaster General.—A.c. signal receiving apparatus. 31st March, 1955. (810724.)

20012. English Electric Co., Ltd.—Clothes drying machines. 1st July, 1955. (810945.)

31194. General Electric Co., Ltd.—Sealing or closure arrangements for vessels or tubes. 26th October, 1955. (810861.)

1955

1192. English Electric Co., Ltd.—Oscillating vane type actuators. 6th January, 1956. (810973.)

8182. British Telecommunications Research, Ltd.—Magnetic recorders for the storage of information in binary form. 28th February, 1956. (810921.)

8582. Philco Corporation.—Electrolytic shaping of semiconductive bodies. 24th March, 1955. (810946.) 11590. Method and apparatus for producing semiconductive structures. 21st April, 1955. (810862.)

20561. Gent & Co., Ltd.—Mechanical devices for operating mechanisms at a particular predetermined temperature. 4th July, 1956. (811013.)

21174. General Electric Co.—Grids for electron discharge devices. 21st July, 1955. (810866.)

21404. Ericsson Telephones, Ltd., and Acton, J. R.—Electronic counting and computing arrangements. 25th July, 1955. (810953.)

25283. Creed & Co., Ltd.—Tungsten concentrated arc lamp. 2nd September, 1955. (810832.)

29992. Telefunken G.m.b.H.—Tautening of filaments of electron-discharge tubes. 20th October, 1955. (810833.)

30662. Sunbeam Corporation.—Electric frying pan. 26th October, 1955. (810728.)

36309. International Business Machines Corporation.—Multiple channel servo-systems. 19th December, 1955. (810985.)

1956

2003. Claude Paz et Visseaux.—Activated electrode for electric discharge lamp. 20th January, 1956. (811016.)

4566. Foster Transformers, Ltd., and Thomas, P. G.—Automatic voltage regulators. 8th February, 1957. (811017.)

5712. Sylvania Electric Products, Inc.—Alloys and the metallising of ceramic or cermet materials therewith. 23rd February, 1956. (810774.)

7688. Baso, Inc.—Electromagnetic control devices. 12th March, 1956. (811064.)

13024. Eigenheer, J.—Apparatus for the combined radiation of ultra-violet and infra-red rays. 27th April, 1956. (811035.)

13438. National Research Development Corporation.—Electrical counting and sealing devices. 23rd July, 1957. (811065.)

15035. British Timken, Ltd.—Mounting of traction motors of electrically driven vehicles. 11th March, 1957. (810961.)

16823. Standard Telephones & Cables, Ltd.—Travelling wave amplifiers. 31st May, 1956. (810873.)

20859. Standard Telephones & Cables, Ltd.—Telephone systems. 5th July, 1956. (810875.)

21191. Calor-Emag Elektrizitäts A.G.—Electrical switch means for direct or alternating current. 9th July, 1956. (810847.)

23044. Soc. d'Electricité Mors.—Circuits comprising thermal switch time-delay devices. 25th July, 1956. (810747.)

23892. Balfour, Beatty & Co., Ltd., and André Rubber Co., Ltd.—Spacing devices for overhead cables. 15th July, 1957. (811038.)

24608. Crompton Parkinson, Ltd.—Electric arc welding of studs and similar bodies. 30th July, 1957. (810876.)

24849. Siemens & Halske A.G.—Electric time-delay circuits. 14th August, 1956. (810782.)

25264. Sulzer Frères S.A.—Forced flow, once-through steam generators. 17th August, 1956. (810877.)

25592. Libbey-Owens-Ford Glass Co.—Electrically conductive transparent articles. 22nd August, 1956. (810750.)

26397. Marconi's Wireless Telegraph Co., Ltd.—Microwave generators. 3rd June, 1957. (811040.)

26900. Telemecanique Electrique.—Speed responsive mechanisms for operating electrical contacts. 3rd September, 1956. (810817.)

29140. Amp, Inc.—Insulated electrical terminal and die for making same. 24th September, 1956. (810881.)

30675. United-Carr Fastener Corporation.—Holders for electric lamp bulbs. 8th October, 1956. (810784.)

30760. Metropolitan-Vickers Electrical Co., Ltd.—Auxiliary supply arrangements for electric traction equipments. 12th September, 1957. (810969.)

31465. Philips Electrical Industries, Ltd.—Processes for electrolytically coating metals with a platinum layer. 16th October, 1956. (810818.)

33502. English Electric Co., Ltd.—Refrigerating apparatus or hot air machine. 1st November, 1957. (810857.)

36076. Philips Electrical Industries, Ltd.—Discharge tube circuit arrangements. 26th November, 1956. (810754.)

36574. General Electric Co., Ltd.—Superheterodyne sound radio receivers. 28th November, 1957. (810994.)

39049. Brown Boveri & Cie. A.G.—Electric circuit-breaker with magnetic blow-out. 21st December, 1956. (810925.)

1957

885. Foxboro Co.—Radioactive measuring device. 9th January, 1957. (811042.)

1215. Etablissements L. Faiveley.—Electrical couplings for railway vehicles. 11th January, 1957. (810787.)

1768. Proctor Electric Co.—Electric bread toasters. 17th January, 1957. (810943.)

2161. Proctor Electric Co.—Latching mechanism for the bread carriage of an electric toaster. (810944.)

5888. General Electric Co.—Electric heating units and methods of making same. 21st February, 1957. (810896.)

7587. Philips Electrical Industries, Ltd.—Rectifying circuit arrangements. 7th March, 1957. (810898.)

17797. Canada Wire & Cable Co., Ltd.—Armoured electric cables. 4th June, 1957. (810789.)

18364. Electrolux Corporation.—Centrifugal blowers. 11th June, 1957. (810909.)

18399. Philips Electrical Industries, Ltd.—Methods of frosting part of the inner wall of a hollow article made from hard glass. 11th June, 1957. (810910.)

18819. Electronique Appliquee.—Keyed signal transmitters. 14th June, 1957. (811048.)

21553. Philips Electrical Industries, Ltd.—Electro-acoustic converting devices. 8th July, 1957. (810912.)

21755. Marie, G. R. P.—High frequency amplifying systems. 9th July, 1957. (811049.)

22943. Allan, A. J., and Booth, P. H.—Electric resistance welding gun. 19th July, 1957. (811051.)

24627. Gas- und Wassermesserfabrik A.G.—Coin-actuated electrical devices for the delivery of liquid from a servicing pump column. 2nd August, 1957. (810998.)

25909. Westinghouse Electric International Co.—Cooking apparatus. 16th August, 1957. (811055.)

28165. Allmänna Svenska Elektriska A.B.—Air blast electric circuit-breakers. 6th September, 1957. (810763.)

29382. Philips Electrical Industries, Ltd.—Electroluminescent elements. 18th September, 1957. (810918.)

30436. Sperry Rand Corporation.—Electro-hydraulic servo system for steering dirigible craft. 27th September, 1957. (811057.)

36492. Westrex Corporation.—Magnetic sound transducing devices. 22nd November, 1957. (810929.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 18th April:—

Transmatic. No. 780,947. Class 9. Electrical control apparatus actuated by changes in temperature or humidity for the remote control of air-conditioning installations.—Teddington Industrial Equipment, Ltd., Teddington Works, Windmill Road, Sunbury-on-Thames, Middx.

Sky Player. No. 782,358. Class 9. Electric batteries, cells, accumulators; radio receivers, television apparatus, gramophones, radio-gramophones, record players; and cases for electric torches.—Ever Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, London, N.7.

No. 780,261 (design). Class 9. Electrically operated valves for automatically controlling the operation of air valves in pneumatic pipe line systems.—A.R.O. Machinery Co., Ltd., 190, Castlenau, Barnes, London, S.W.13.

Sanacon. No. 784,226. Class 9. Electric switches.—J. Ruse, 60, Moss Heights Avenue, Glasgow, S.W.2.

Resistoneal. No. 779,812. Class 11. Electric resistance heating apparatus for use in annealing wire and wire rod by means of electric current induction, and parts.—Winget, Ltd., Winget Works, Rochester, Kent.

Gaylon. No. B781,718. Class 11. All goods included in this class.—General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

Eswa. No. 784,200. Class 11. Electric heating apparatus.—R. Meinich, Oslo, Norway. Address for service, c/o Heron, Rogers & Co., 181, Queen Victoria Street, London, E.C.4.

Underground Railway Project

One of the measures contemplated by the Buenos Aires Transport Corporation to reduce its heavy financial deficit, says the *Monthly Journal* of the British Chamber of Commerce in the Argentine Republic, is to extend the underground railway system. It is proposed to add 143 km to the existing network in the next eight years at the rate of up to 20 km a year. This is expected to produce an annual increase in net revenue ranging from 100 to 800 million pesos.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Victoria Railways, Melbourne. 1st April. Train lighting equipment. (E.S.B. 6770/59. Ten/37986.)*

Australian Aluminium Production Commission, Bell Bay. 14th April. Ten 33 kV circuit-breakers. (E.S.B. 6964/59. Ten/38030.)*

Secretary for Railways, Hobart, Tasmania. Three sets of equipment for diesel general service locomotives. (E.S.B. 6785/6/59. Ten/38005/6.)*

Canada.—Manitoba Hydro-Electric Board, Winnipeg. 9th April. Supervisory equipment for the Pine Falls hydro-electric power station. (E.S.B. 6707/59. Ten/37949.)*

Croydon.—Corporation. Firms wishing to supply floodlighting and other illumination equipment on hire for the Millenary celebrations, 1960, should send details to the borough engineer. (See this issue.)

Formosa.—Central Trust of China, Taipei. 10th April. Power station equipment, including indoor power centre and busway, lighting/distribution panel boards, and electrical fittings (fluorescent lighting, tumbler switches, etc.). (E.S.B. 6150/59/I.C.A. Ten/37887.)* 13th April. Two 75 h.p. and two 50 h.p motors and starters. (E.S.B. 6912/59/I.C.A. Ten/38057.)*

India.—Madras State Electricity Board. 15th April. Indoor and outdoor lighting installation at the Kundah power station. (E.S.B. 5854/59. Ten/37927.)*

Calcutta Corporation. 1st May. Four electrically driven pumping sets. 5th May. Three electrically driven pumping sets. (E.S.B. 6052/59. Ten/37808.)*

India Supply Mission. 7th May. 66 kV power circuit-breakers for Bhadra power station and Shimoga receiving station. (E.S.B. 6084/59. Ten/37814.)* 14th May. Control panels, switchboards and battery charging sets for Bhadra station. (E.S.B. 6085/59. Ten/37810.)* 20th May. Turbine, generator, transformer and control gear for Tungabhadra hydro-electric project. (E.S.B. 6082/59. Ten/37811.)*

Iraq.—Central Foreign Purchase Committee, Ministry of Finance. 9th April. Galvanised conduit pipes. (E.S.B. 6329/59. Ten/37902.)*

Korea.—Government Office of Supply, Seoul. 8th April. Fifteen 30 kW generator sets, arc welders, welding outfits, etc. (E.S.B. 6336/59/I.C.A. Ten/37909.)* 9th April. Capacitor banks. (E.S.B. 6334/59/I.C.A. Ten/37912.)*

Manchester.—Corporation. 20th April. Electrical installation in underground car park, Market Place. (See this issue.)

Mitcham.—Corporation. 25th April. Street lighting equipment. (See this issue.)

New Zealand.—Hamilton City Council. 15th April. Two 750 kVA and two 500 kVA transformers. (E.S.B. 6588/59. Ten/37933.)*

Rhodesia and Nyasaland.—Federal Tender Board, Causeway. 3rd April. Three 100 kVA transformers. (E.S.B. 6696/59. Ten/37941.)* Three 1·5 kVA and one 20 kVA transformers. (E.S.B. 6693/59. Ten/37944.)*

Salisbury Corporation. 7th April Amplifier equipment. (E.S.B. 6748/59. Ten/37961.)* Annual supplies of equipment:—

21st April. Load-limiters. (E.S.B. 6741/59. Ten/38004.)* Lighting equipment and lamps. (E.S.B. 6742/59. Ten/37958.)* 28th April. Cable boxes and accessories. (E.S.B. 6743/59. Ten/37960.)* Insulating cables and conductors. (E.S.B. 6745/59. Ten/37957.)* 5th May. Line materials and conductors. (E.S.B. 6744/59. Ten/37955.)* 19th May. Switch, fuse and ancillary gear and equipment. (E.S.B. 6747/59. Ten/37989.)*

Salford.—Corporation. 5th May. Electric lamps and cables for the year ending 30th June, 1960. (See this issue.)

South West Africa.—Windhoek Electricity Department. 11 kV switchboard. (E.S.B. 6544/59. Ten/37920.)*

Stirlingshire. — County Council. Street lighting installation, Bonnybridge. (See this issue.)

Thetford.—Corporation. 11th April. Electrical installation in a factory on London Road industrial estate. (See this issue.)

Wigan.—Corporation. 10th April. Street lighting equipment. (See this issue.)

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Dagenham.—Fire station, workshops, etc.; Distillers Co., Ltd., Chequers Lane.

Dover.—Redevelopment of Buckland Hospital; F. R. Bywaters, electrical consultant, 26, Seymour Street, London, W.1.

Dunstable.—Houses (261), Hadrian estate; Pearce & Barker, Ltd., 71, Leagrave Road, Luton.

Durham.—Additions to St. John's College (£75,000); Cordingley & McIntyre, architects, Owengate, Durham.

Further instalment of new Grey College for Durham University; J. & W. Lowry, builders, 64, Bath Lane, Newcastle-on-Tyne.

Crematorium at South Road Cemetery for Central Durham Crematorium Committee; Chaplin & Burgoine, architects, 4, Cathedral Close, Norwich.

Additions to Neville's Cross training college (£245,000); Crudens, Ltd., contractors, Musselburgh, Midlothian.

Eccles.—Four ten-storey blocks of flats, Barlow Street and Cawdor Street; borough surveyor.

Works, Weymouth Road; St. Michael Engineering Co., Knott Street Works, Salford.

Edmonton.—Maisonnettes (48); H. Backhouse, town clerk, Town Hall, N.9.

Enfield.—Hostel for the British Transport Commission; Dr. F. F. Curtis, chief architect, 222, Marylebone Road, London, N.W.1.

Fareham.—Houses (183); surveyor, Westbury Manor, Fareham, Hants.

Grays.—Houses (200); Grays Thurrock Properties, Ltd., The Barn, Dell Road.

Honiton.—Houses (40), Jerrard Estate; Anthony Lamb, architect, 2, Prospect Place, Ottery St. Mary, Devon.

Horsham.—Flats (36), Needles estate; C.B.H. Constructions, Ltd., 36, High Street, Tarring, Worthing.

Ipswich.—Junior school, Sprites Lane; Geo. A. Kenney & Sons, Ltd., Army Works, Burrell Road.

Jarrow-on-Tyne.—New dry dock for Mercantile Dry Dock Co., Ltd. (£1,000,000); Sir Robert McAlpine & Sons, Ltd., contractors, 81, Jesmond Road, Newcastle-on-Tyne.

London.—Two seven-storey blocks of flats, 16/17, Grosvenor Square, W.1; Lewis Solomon, Kaye & Partners, architects, Thavies Inn House, E.C.1.

Reconstruction of Islington Borough Baths, Hornsey Road, Upper Holloway; E. Wingfield-Bowles & Partners, consulting engineers, 32, Old Queen Street, S.W.1.

Houses (68), Heavitree Road, Waverley Crescent and Warwick Terrace, Woolwich; W. H. Ginson, borough engineer, Town Hall, S.E.18.

Longbenton.—R.C. aided primary school (£119,000); R. Burke, architect, Lambton House, Lambton Road, Newcastle-on-Tyne.

Manchester.—Nine-storey office block, King Street; J. Gerrard & Sons, Ltd., builders, Swinton.

March (Cambs.).—Houses (48) to complete Upwell Road estate; U.D.C. surveyor.

Middlesbrough.—Flats (52) and 13 houses, St. Hilda site; J. A. Kenyon, borough engineer.

Midlothian.—Infants' school and clinic at Bilston; county architect, 32, Palmerston Place, Edinburgh.

Newport (I.O.W.).—Additional storey, extensions to ground floor and erection of vehicle maintenance shop at fire station; county architect, County Hall, Newport.

North Riding.—Grammar and modern school, Thirsk; J. Leathart & Son, architects, 49, Welbeck Street, London, W.1.

Offices at Westgate, Guisborough (£21,000); H. J. Knowles, county architect, Northallerton.

North Shields.—Factory extensions for Dukes & Markus, Ltd.; Hastie D. Burton, Ltd., builders, King Street, South Shields.

Northumberland.—Child welfare centre at Tweedmouth; county architect, County Hall, Newcastle-on-Tyne.

Nottingham.—Hostel (£52,000), Clifton estate; Bosworth & Co., Ltd., builders, Quorn Road.

Slough.—Houses (68); Wates, Ltd., builders, 1258, London Road, London, S.W.16.

South Shields.—Welfare hostel, Wenlock Road (£41,000); Whittal, Ltd., builders, 95, Pilgrim Street, Newcastle-on-Tyne.

Factory additions, Readhead Street, for Tyne Wire Rope Manufacturing Co., Ltd.; S. W. Milburn & Partners, architects, 9, Esplanade, Sunderland.

Junior mixed school at Whiteleas; Page, Son & Hill, architects, 75, King Street, South Shields.

Flats, Slake Terrace; J. Reid, borough engineer.

Stockton-on-Tees.—Houses (36), Tunstall Road, etc.; R. B. Bainbridge, Ltd., builders, Prudential Buildings, High Street, Stockton.

Stoke-on-Trent.—Shops and offices on site off Stafford Street, Hanley (£61,000), and second phase of extensions, King's Hall (£65,000); W. A. Bott, borough surveyor, Town Hall.

Totnes.—Civic hall and covered market, High Street; G. A. Jellicoe & Partners, architects, 12, Gower Street, London, W.C.1.

Twickenham.—Extensions (£80,000), Fortescue House School, Hampton Road; Brewer, Smith & Brewer, architects, 11, The Green, Richmond, Surrey.

Wakefield.—Showrooms and offices, Lower Kirkgate; Arthur Swift & Partners, architects, 21, Upper Grosvenor Street, London, W.1.

Walsall.—Community hall, Streetly; Hickton, Madeley & Salt, architects, Ashley House, Hatherton Road, Walsall.

Wembley.—Home for old people at Copland Road (£69,225); C. G. Stillman, Middlesex county architect, 1, Queen Anne's Gate Buildings, London, S.W.1.

Whitley Bay.—Eleven-storey blocks of flats, 235 houses, shopping centre, etc., Whitley Lodge estate; M. J. Liddell & Son, builders and contractors, 36, Great North Road, Newcastle-on-Tyne.

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